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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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CONTENTS

GENERAL

EXPERT DISTURBED BY PACE OF COMPUTERIZATION

Moscow SOVETSKAYA ROSSIYA in Russian 31 Jul 86 p 2

[Interview with N.N. Moiseyev, member of the academy, by A. Nemov and G. Georgiyev: "A Compass for the Economy"; date and place not given]

[Text] [Question] Nikita Nikolayevich, this is not the first year that complaints have been heard about how we are lagging some 10 years behind the advanced countries in computers. It is like a charmed circle. Every year we all but redouble our efforts, we bring in thousands of new specialists, but we are altogether unable to catch the leaders....

[Answer] It only seems at first to be a charmed circle. At the end of the fifties I had occasion to visit one of the European computer centers. I was amazed not only by the external similarity between their computers and ours, but also that all the operating procedures of the personnel were identical. There was no question whatsoever of any lag.

The difference in the pathways of development and use of technology dates from about 1960. That is when they began in the West to actively apply the computer in the management of production. The gain from introducing the new methods of processing information proved to be so great that the output of computers left behind all other sectors in terms of growth rate. Unfortunately, our economists "overlooked" the fact that improvement of the management of production is bound up precisely with the computer. Oversights of a purely technical nature came on top of that. Great harm was done to the development of computers in the Soviet Union by the aspiration of certain managers in the economy to limit themselves only to copying foreign examples to the detriment of creating domestic designs. The position taken by a number of ministries which did not want the new technology introduced at their enterprises became for all practical purposes an unsurmountable barrier. So now we have to make up the ground that has been lost....

[Question] You said that the economists "overlooked."... Explain this in more detail.

[Answer] Today at least 30 percent of all people working are employed in processing information in one way or another. Every month and every quarter fat volumes of reports are prepared in organizations, and as on a conveyor they move from the lower levels of management to the upper levels.

In essence one and the same figure is transferred from paper to paper some six or eight times. Institutions use various pretexts to get new staff positions in order to create numerous documents. This increases the already fat administrative structure. And the main thing is that sometimes the "living fact" cannot be seen behind the abundance of paper. There are times when a directive is outdated by the time it reaches the production link. The great number of levels of agreement does not allow speedy decisions to be taken.

You will agree that the seasonal production of the products of light industry so as to take into account the latest vagaries of fashion are at times an unrealizable dream for us. After all, to produce, say, a fashionable jacket the right fabric has to be made at one enterprise, the dye at another, and the zippers and buckles at another. This means that dozens of signatures have to be obtained from the appointed officials. At present this takes years.... What is the way out? It is possible to broaden the bounds of enterprise independence, it is possible to reduce the number of management levels--and this is necessary!--but unless the new methods of working with information are used, the "fight" against the "paper dragon" will not yield results. This is the road that has been taken by all the economically advanced countries in laying the foundation for a management technology without paper.

What are we referring to? To application in the sphere of management of the economy fundamentally new communications--computer networks which would bring together into unified complexes the computers in use at various enterprises and departments not only in one city, but throughout entire regions. By means of such networks it is possible not only to transmit data from one level of management to another, but also to accomplish management of complicated and geographically scattered systems: for example, the country's unified power system. Even today there are quite a few examples of effective use of computer networks: regulating flows of rail and highway transport, managing the supply of stores and other enterprises serving the public. All of this is the ABC's of present-day informatics. But now it is a question of completely altering the structure of management. The present technology makes it possible to change the customary pathway of information from "lower-level" organizations to "higher-level" organizations. The "higher-level" organizations will be able on their own to extract the necessary information on operation of their subordinate enterprises and to look at the matter as it were from inside. They will be able to obtain all the information necessary for making decisions by computer on the screen of the monitor.

[Question] The extensive computerization of the economy you have been talking about would seem to completely nullify the role of the human being; that is, it would not matter whether the effort was being directed by a good or bad economic manager. The computer "calculates" all possible decisions, chooses those which are optimal, and goes beyond that to quickly inform the operative and then to "report" on the results of his activity.

[Answer] That is the way it seems sometimes to many scientists and economists. By means of the computer we have learned to calculate the most complicated versions of "optimal plans," to link up the operation of dozens of enterprises in different sectors. In short, to make plans for most economic indicators--

at the top level. But they had one drawback--they were not carried out! The blame might be put on enterprise directors for lax enforcement of work discipline, reference might be made to objective difficulties, but this is only part of the problem. Our "optimal targets" did not take into account the role of socioeconomic mechanisms, whose task it is to invigorate the economy, to speed up its development, and to place the plan on a real foundation. In compiling economic forecasts can the computer take into account man's role in the economy? It turns out that it can. But to achieve that the mathematicians and economists have to go down to the level of real production. This has been fully demonstrated by an experiment carried out by the Computer Center of the USSR Academy of Sciences.

Three years ago several staff members of the VTs put a personal computer on the back seat of a car and set off on an ordinary day to Glazunovskiy Rayon in Orel Oblast for a conference on the problems of interkolkhoz cooperation. A large swine-raising complex had been set up on one of the kolkhozes in the rayon. Its neighbors were supposed to deliver suckling pigs to it for raising. This cooperative project required solutions for a countless set of economic problems. The kolkhoz chairman proposed their unit prices and their conditions. These were immediately fed into the personal computer, and the result appeared on the monitor screen. It took a few hours to work out the optimum solution. I should mention that it was not the mathematicians who calculated it, but the farms themselves (with the help of the mathematicians) found what was most profitable for everyone.

The experiment in Glazunovka confirmed once again that computers do not replace man in management, but only augment many times over his creative capabilities, but the decision is still made by the manager, there is no computer that can relieve him of that.

[Question] Nikita Nikolayevich, we would like to go back to the beginning of our conversation--to the problem of the development of computers. You stressed that a correctly chosen strategy is extremely important here. It will now be defined by the USSR State Committee for Computers and Informatics.

What problems will the committee face?

[Answer] According to the decree of the CPSU Central Committee and USSR Council of Ministers, it has been given responsibility for coordinating the entire effort of creating, manufacturing, using, and maintaining computers in the country's economy. Performing those tasks, of course, requires a structural reorientation and this will affect more than one ministry and department. Fundamental changes have long been necessary, since the low quality of domestic computers and the inability (or reluctance) to include them in the appropriate organizational structures is holding back scientific-technical progress and has become a barrier preventing management of the economy from moving to a new level.

Why is the problem of quality such an acute one? Well, because serious claims have been presented to computer manufacturers, they have immediately passed them on to their plants which are the manufacturers of the various components,

and they in turn pass the buck to suppliers from another ministry, and so on. There seem to be many at fault and no one to call to account. The experience of the largest foreign firms which manufacture computers shows that the quality of the individual components must be checked not by the plants producing them, but by enterprises which stand at the end of the chain of computer manufacturing. They bear full responsibility for the finished product. Now that the new committee has been created, it will become possible for us to apply that principle as well.

There is another problem that I cannot fail to speak about. Neither the variety nor the number of computers produced satisfy today's requirements. During this 5-year planning period their output is supposed to increase 2-2.3-fold. But we should note for comparison that in certain countries that kind of growth in the production of personal computers was achieved during the eighties in just 1 year (in the United States, for example, a million computers in this class were produced back in 1980).

Nor can one fail to be uneasy about the acute shortage of terminals, especially color displays and plotters. This reduces the capabilities of the computer to a fraction.

Because of the insufficient assortment of computer hardware produced there are typical situations today in which an institution could solve economic problems if it had a computer worth 10,000-15,000 rubles, but it must use a computer in the YeS series and pay tens of thousands of rubles per year for computer time. In such a case can there be any question of computers showing a return? This gives rise to a paradoxical situation--although there is an acute shortage of computers, the present stock of computers is being used at a level of less than 50 percent. Another task of the new committee is to achieve not merely extensive dissemination of computers, but also their effective use....

In conclusion of this interview I would like to emphasize that computers are not simply a new technology for processing information which can be "introduced" or "not introduced" depending on the subjective attitude toward them of the responsible officials in ministries and departments, but this is the objective basis of scientific-technical progress, which is to say of the entire economy.

7045
CSO: 1863/4

LASERS AND QUALITY

Riga NAUKA I TEKHNIKA in Russian No 7, Jul 86, pp 16-17

[Article by Donat Karlovich Millers, candidate of physical-mathematical sciences, head of the Radiation Physics Laboratory of the Institute of Solid State Physics, Leningrad State University; first paragraph appears in boldface in source]

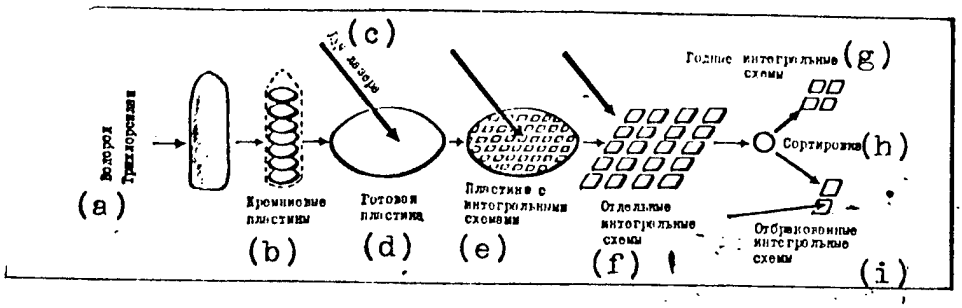
[Text] Laser devices help in checking quality of semiconductor materials and assure the requisite precision of manufacture of integrated circuits. Integrated circuits have arrived to supplant individual diodes and transistors, long used in electronic engineering. These constitute a functional assembly (for example, an amplifier), the components of which--transistors, diodes, capacitors and resistors--are arranged on a single substrate of semiconductor material. Not only ordinary, but also large and even very large integrated circuits are produced, containing several functionally interconnected assemblies (or possibly a microprocessor, which is a part of a computer) on a single semiconductor substrate. In a large integrated circuit, which structurally has many layers, all the components (which may number several tens of thousands) are arranged on a substrate of roughly 10 mm^2 in area. The dimensions of the components are exceedingly small, and therefore the manufacture of integrated circuits demands high precision, while the semiconductor substrate must have high homogeneity.

The latest achievements of science and technology make possible such precision and an effective quality inspection of semiconductor materials. Perhaps the most promising is the use of optical methods, based on powerful sources of light, such as the laser. The advantages of lasers primarily stem from two properties--monochromaticity (single-coloredness) of the emitted light and almost ideal parallelness of the light rays in the beam. A monochromatic light beam, consisting of nearly parallel rays, can be focused by a lens into a beam of light whose dimensions in the focal plane of the lens are less than one micrometer. (Hereafter, instead of the concept "beam of light rays" we shall use the more laconic "light beam" or "laser beam", when it is a question of the emission of a laser.) A light beam of small transverse dimension can be used both as a tool in the manufacture of integrated circuits, and to check the quality of semiconductor materials, and to check the functioning of the finished circuits.

The quality of a semiconductor chip depends on its homogeneity and the uniformity of distribution of dopant in it. There are two different methods of laser beam checking.

Under the influence of laser light, free electrons are produced in the semiconductor, which become carriers of electric current when an external voltage is applied to the semiconductor. Such current is known as a photocurrent and its force under constant illumination depends on the heterogeneity of the semiconductor structure and the quantity of dopant in it. In those regions of the semiconductor where the concentration of dopant is greater, generally a stronger photocurrent is induced.

The inspection of semiconductor chips is done in a special installation. From this, simultaneous information as to the position of the laser beam on the chip and the strength of the photocurrent is sent to a storage unit. Heterogeneity of the chip structure or heterogeneity of the distribution of dopant is detected in the process of analysis of the resulting information--from the anomalous strength of the photocurrent in a particular region.

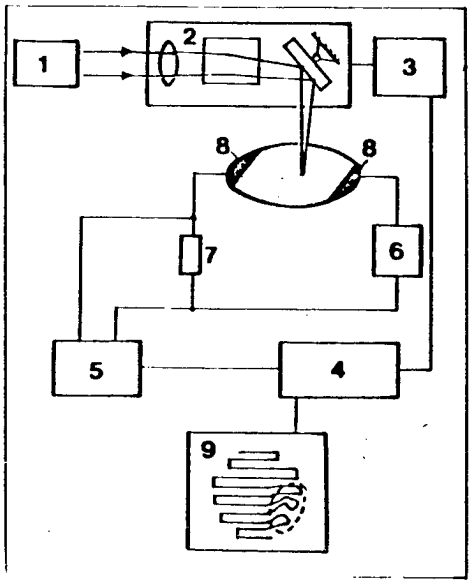


Simplified sequence of manufacture of an integrated circuit. A laser beam is used during four stages: to check the manufactured chip, to tune the integrated circuit, to cut out the chip into individual integrated circuits, and to discover inoperative circuits.
Key:

a. Hydrogen trichlorsilane
b. Silicon chips
c. Laser beam
d. Finished chip.
e. Chip with integrated circuits
f. Individual integrated circuits
g. Good integrated circuits
h. Sorting
i. Rejected integrated circuits

Further analysis provides an idea as to the suitability of the semiconductor chip for use in integrated circuits. This information is processed by computer and thus the quality of the chip is quickly determined. The principal merit of the described layout is its simplicity; the main defect is that only the surface layer of the semiconductor chip is inspected--the light inducing the photocurrent does not reach the interior.

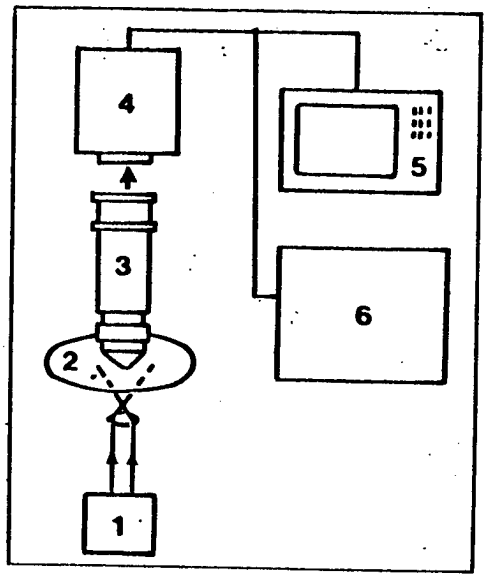
Quality inspection can also be done in layouts whose operation is based on the use of a laser beam penetrating into the semiconductor chips. In this case, no photocurrent is induced.



Layout for checking finished chips. A light beam (1) arrives at a focusing device (2), which moves it over the surface of the chip by means of movable mirrors and zig-zags. A special unit (3) controls the displacement of the light beam and sends information about its position (coordinates of the illuminated spot) and the strength of the photocurrent induced in the chip to a storage (4). Usually, the photocurrent is so small that an amplifier (5) is needed. The photocurrent flows through the chip, thanks to a power source (6) hooked up to it by means of a resistor (7) and electrodes (8). The broken line shows a region of elevated strength of photocurrent.

The semiconductor chips are thus separated into good and reject chips. The good chips are sent along for manufacture of integrated circuits: on each such chip, several hundred basically identical integrated circuits are arranged. All of these are manufactured at the same time, although the circuits do not turn out completely identical and (which is very important) the parameters of these circuits do not always comply with the nominal values. Therefore, the industry assigns a very important position to the checking and tuning of the integrated circuits. The tuning is done by

changing the resistance of the resistors and the capcities of the capacitors. In an integrated circuit with an area of several square millimeters, each component--whether a resistor or a capacitor--is very tiny (no more than several dozen micrometers). Therefore, the tooling instrument should be minuscule and precise. A focused laser beam is suitable for this purpose. The power of the laser beam may be so intense that a thin surface film of any given metal will evaporate when coming into contact with it. This is done most easily by using a pulsed laser, emitting a maximum energy in a short interval of time (one hundred-millionth of a second).



Layout for inspection of semiconductor material. A laser beam (1) is sent through a semiconductor chip (2), impinges on a microscope (3), and from there goes to a special television camera (4). A video monitor (5) is used for visual inspection, while a storage (6) gathers the information.

When tuning an integrated circuit, the focused laser beam cuts out (as it were) a portion of the resistive layer, thereby increasing the resistance of the component. The cutting is done gradually, paying heed to the changing parameters of the integrated circuit and the power of the laser beam in order to avoid damaging the lower-lying layers.

A component in need of tuning must be found from among a multitude of components, which can only be viewed under a microscope. Quick and flawless performance of the work involved in tuning can only be done with a high-precision automated layout, which is complicated but even so profitable.

After this comes the next stage in the production process. The semiconductor chip with its many integrated circuits is divided into separate circuits. Usually, this is done on a special layout by diamond cutters. But mechanical cutting produces stresses, which alter the properties of the circuit components. Such mechanical stresses may be avoided in part by using a laser beam as the "knife."

Despite meticulous production control, it may happen that some of the integrated circuits do not work. It is impossible to fix these, but essential to discover the cause of the rejects, in order to find and correct the flaw in the technological process.

One of the methods of integrated circuit inspection is similar to the method of quality control of semiconductor chips and is based on induction of a photocurrent. It turns out that the strength of the photocurrent induced in various places of an active component of an integrated circuit (e.g., a transistor) can be used to determine whether this component is working or even what is the nature of the damage.

Contemporary microelectronics is going through a headlong development. The operational reliability of devices, including integrated circuits, is increasing, and their dimensions are decreasing. However, it is still too early to speak of reaching the limit of improvement and miniaturization of microelectronic structures.

12717
CSO: 1863/9

YeS-2700 MATRIX PROCESSOR

Yerevan KOMMUNIST in Russian 14 Jun 86 p 1

[Article by V. Musayelyan: "Millions of Operations Per Second"]

[Text] A team of scientists and engineering and technical personnel of the Yerevan NII for Mathematical Machines has completed a new development--the YeS-2700 matrix processor.

A state commission chaired by A. Dorodnitsin, Hero of Socialist Labor, recipient of the Lenin and State Prizes of the USSR, and member of the USSR Academy of Sciences, has taken note of the overall high scientific-technical level of the development and has recommended that it be put into series production.

Present-day general-purpose computers are able to solve a class of problems in a broad range in various fields of science, engineering, and the economy with a sufficiently high rate of output, performing several million operations per second. A matrix processor is one of the specialized devices capable of speeding up computations by a two-digit or three-digit factor. For example, a configuration consisting of the YeS-1045 computer and the YeS-2700 matrix processor makes it possible to achieve a productivity up to 120 million operations per second, which is comparable to the output of a supercomputer. It is also possible to plug as many as three matrix processors into the computer at the same time. That configuration "works" at a speed that goes as high as 300 million operations per second.

There are a number of other features and virtues that distinguish the YeS-2700 matrix processor--its compatibility with all models of the YeS series of computers, its capability of solving as many as seven users' problems at the same time, and the possibility of new operations being included in its instruction set in order to expand the domain of its use, and so on.

M. Semerdzhan, director of the institute, doctor of engineering sciences, recipient of USSR and ArSSR State Prizes, who was the scientific director of the development project, made a large contribution to development of the matrix processor.

The process of creating the device was headed by L. Gasparyan, candidate of engineering sciences and recipient of the USSR and ArSSR State Prizes. The

logic capability was developed under the direction of Zh. Nalbandyan, candidate of engineering sciences and deputy chief designer.

"The YeS-2700 matrix processor required many years of strenuous work on the part of its creators," said chief designer L. Gasparyan. "A large contribution was made by our systems engineers, mathematicians, designers, and electronic engineers. Among them we should mention T. Kuznetsova, L. Andreasyan, S. Malkonyan, S. Khachatryan, L. Avakova, L. Martirosyan, K. Arakelyan, and L. Chakhoyan. Of course, you cannot name them all. It is thanks to their fruitful work that today's success has come about.

PHOTO CAPTION

Creators of the new machine follow the operation of the YeS-1045 computer combined with the YeS-2700 matrix processor--L. Avakova, chief designer of the matrix processor, L. Gasparyan, winner of the USSR and ArSSR State Prizes, and Zh. Nalbandyan, deputy chief designer.

7045
CSO: 1863/4

SETTING STANDARDS ON CONSUMPTION OF MAGNETIC MEDIA

Moscow VESTNIK STATISTIKI in Russian No 7, Jul 86 pp 48-52

[Article by V. Vasilyeva, chief project engineer of VNIPIuchet [All-Union Scientific Research and Design Institute for Accounting and Recordkeeping]; M. Lermontov, chief of the Administration for Capital Construction and Material and Technical Supply; and S. Polikarpov, group chief of VNIPIuchet, all of USSR Central Statistical Administration]

[Text] Work is being done in the system of the USSR CSA to create and improve the set of standards, quotas, and allowances and to develop and apply standard allowances and rates for the consumption of supplies in the practical operation of a computer center.

The principal directions of the efforts to set standards on consumption of physical stocks are as follows: introduction and application of intersector (uniform and model) standard allowances and rates; the development, introduction, and application of sectorwide (departmentwide) standard allowances and rates; and the development, introduction, and application of local standard allowances and rates.

The principal magnetic media (MN) used in processing data by computer are magnetic tapes (ML) and magnetic disks (MD). But we should note that often their use is inefficient in the practical operation of the computer center. The volume of external data storage on the MN is sometimes not fully used, data are ineffectively distributed on them, and the media themselves are not efficiently distributed among tasks.

The Center for Scientific Organization of Work and Management of the USSR CSA worked out "Standard Rates of Consumption of Magnetic Tapes and Magnetic Disks at Computer Installations (VU) in the System of the USSR CSA" on behalf of efficient use of magnetic media in processing data at computer centers.

Computer centers in the system of the USSR CSA are to be guided by these standards in planning the necessary number of MN to perform a given amount of work.

The types of operations to be performed and the computing resources in the system of the USSR CSA have mainly been standardized, so that the standard rates of consumption of MN were calculated specifically for computer centers at the republic, oblast, and city (rayon) levels.

In view of the fact that the computer centers in the system mainly process data on computers in the YeS series and the PVK M 5000, the consumption of media was determined for that computer equipment. Each type of magnetic media has a standard amount of external storage (data capacity).

The following minimum standard capacities of the magnetic media were adopted as a standard unit for convenience in computation: 7.25 and 1.3 megabytes for magnetic disks and 375 meters for magnetic tape. Accordingly the rates of consumption of MN shown in the standard tables are given in these conventional units (Table 1).

Table 1

Standard Capacity of Magnetic Data Carrier		Number of Conventional Units
MD	YeS computers	
29 megabytes		4
7.25 megabytes		1
	PVK M 5000	
5.1 megabytes		4
2.56 megabytes		2
1.3 megabytes		1
ML		
750 meters		2
375 meters		1

The standard rates were calculated as a function of the factors influencing the consumption of ML and MD (the nature and number of tasks performed, the load on the computer, the number of media storage conditions, and so on). Before the standards were worked out, a preventive survey was conducted and there was a study and analysis of the data processing technology at computer centers in the system of the USSR CSA, of the nature of the tasks performed, of the system for keeping records on consumption of magnetic media and on the conditions and patterns of their use and storage.

The initial data for designing and developing the standard rates of consumption of magnetic media was gathered at 100 computer installations in the computer network of the USSR CSA at various levels.

The quantitative and qualitative factors that have the greatest influence on consumption of magnetic media were discovered as a result of this survey.

The quantitative factors include the size of computational resources (number of computers), hours of computer operation, the average daily load on the computers (the standard established for computer centers in the system of the USSR CSA or the average load on the relevant type of equipment), the amount of information to be stored, the data capacity of magnetic media (size of

the external storage), the period of time the data are stored (number of days the data recorded on the MN must be preserved), the length of the interval in repetitive performance of tasks, the number of organizations served, the utilization coefficient of the MN (percentage filled), and the planned and actual working life of the ML and MD.

By "qualitative characters" we mean indicators reflecting the organizational and technical conditions of the performance of operations: the way in which the storage of data is organized (the making of duplicates, backup copies), the way in which the ML and MD are used, storage conditions, the servicing of ML and MD, optimum organization of the technological process of data processing, the technical compatibility of the media, the operating conditions of the computer (single-program or multiprogram operation), the type or make of computer, and the possibility of rerecording on the MN.

These factors were ascertained and ranked by degree of importance on the basis of experience in mechanized statistical data processing at the computer centers in the system of the USSR CSA.

The graph method was used in analyzing the consumption of MN and in discovering the dependence of that consumption on the values of the principal parameters. The number of MN needed was determined by using the computational-analytical method.

In designing the standard rates of consumption of ML and MD the information used in solving the problems was classified into relatively permanent information and relatively variable information. That information was regarded as relatively permanent which remains without change or changes slightly over a lengthy period of time and is used many times in the computations. The relatively variable information is information arising in the process of production and economic activity or other activity; it reflects those processes and is used in calculations only in the course of the reporting period.

The stability coefficient of each type of information was determined by expert evaluation. The value of the stability coefficient, which characterizes the ratio of the quantity of information which has remained unchanged over a certain period of time relative to the entire quantity of information, must be greater than or equal to 0.7 for the relatively permanent information. For the relatively variable information it is less than or equal to 0.3.

The classification made it possible to determine the total amount of these types of information for each type of carrier, the actual length of storage of the relatively permanent information involved in the performance of particular operations, and to discover whether it is used to solve one or several problems, to calculate its percentage in the total consumption of magnetic data carriers per unit of performance of the operation.

Patterns influencing consumption of the magnetic media or causes giving rise to deviations were established, and the numerical value of the factors were calculated (see Table 2).

Table 2. Data on the Values of Factors Used To Calculate the Standard Rates and Allowances

Indicator	Organizational Designation: LaSSR Republic Computer Center of CSA	LiSSR Shared-Use Republic Computer Center of CSA	ESSR Shared-Use Republic Computer Center of CSA
Computer operating time per year, hours	15,911	11,286	25,200
Number of tasks performed per year, units	135	132	295
Quantity of ML			
750-meter reels	782	1,128	2,720
375-meter reels	472	814	--
Quantity of MD			
29 megabytes, number of units	44	123	153
7.25 megabytes, number of units	203	93	87

The rates of consumption were calculated with this formula:

$$N_r = K \cdot F_1^a \cdot F_2^b \cdot F_3^c,$$

in which: N_r--rate of consumption of magnetic media;
K--constant coefficient of the regression equation;
F_1^a, F_2^b, F_3^c--numerical values of the factors;
a, b, c--regression coefficients characterizing the degree of influence of the respective factor on the size of the rate.

Standard tables were compiled according to the results of the calculations; they contain the code number and designation of the consumption subject to the standard, the units of measurement adopted, the size of the consumption of magnetic data carriers, and the values of the factors influencing the value of the rate of consumption.

We will give an example of a standard table for magnetic disk consumption for a YeS computer at the republic level.

Table 3. Standard Table for Consumption of MD for a YeS Computer

Level of Annual Computer Operation, number of hours	Number of Tasks Performed: Fewer Than 20	21-40	41-60	61-80	81-100	101-130
	Number of Conventional Units of Magnetic Disks					
1	2	3	4	5	6	7
Fewer than 1,000	65	69	73	78	83	88
1,001-1,500	70	75	80	85	90	96
1,501-2,000	76	81	86	92	98	104
2,001-2,500	83	88	94	100	106	113

Table 3 (continued)

1	2	3	4	5	6	7
2,501-3,000	90	96	102	109	116	123
3,001-3,500	98	105	111	118	126	134
3,501-4,000	106	113	120	128	136	145
4,001-4,500	116	123	131	140	149	158
4,501-5,000	126	134	143	152	162	172
5,001-5,300	136	144	154	163	174	185
Index number of the standard	a	b	c	d	e	f

Level of Annual Computer Operation, number of hours	Number of Tasks Performed: 131-160 Number of Conventional Units of Magnetic Disks	161-200 Number of Conventional Units of Magnetic Disks	201-240 Number of Conventional Units of Magnetic Disks	240 or More Number of Conventional Units of Magnetic Disks	Code Number of Standard
1	8	9	10	11	12
Fewer than 1,000	89	90	91	92	1
1,001-1,500	97	98	99	100	2
1,501-2,000	105	106	107	109	3
2,001-2,500	114	115	117	118	4
2,501-3,000	124	126	127	129	5
3,001-3,500	135	137	138	140	6
3,501-4,000	147	148	150	151	7
4,001-4,500	160	161	163	165	8
4,501-5,000	174	176	178	180	9
5,001-5,300	187	189	191	193	10
Index number of the standard	g	h	i	j	

Standard tables of consumption of magnetic media were also calculated by a similar method for other types of computers.

To discover the nature of the revisions that need to be made in the draft version of the standards, a test was run of the standards at computer centers in the system of the USSR CSA. In the trial stage the computer centers furnished the developers information of a comparative nature describing the actual existence of the magnetic media and the supply necessary to perform a given amount of work within the context of the standards.

The organizational and technical conditions for use and storage of the MN, the degree of accuracy of the standards, their optimality and convenience of using them were also looked at closely during the testing process.

The standards were adjusted, a final version was calculated, and they have been approved and are mandatory at the computer installations in the system.

The size of the direct economic benefit, the indicators of which are calculated so as to meet the conditions of the existence of one and the same mix and volume of data to be processed in the variants compared is the basis for quantitative estimation of the effectiveness of using the standard rates of consumption of MN.

The annual saving from applying the standard rates of consumption of MN was defined as the sum of the annual savings at the computer centers of the system of the USSR CSA at the republic, oblast, and city levels.

For republic computer centers the total annual savings resulting from reduced consumption were determined for ML and MD, respectively, with the following formulas:

$$E^r_{ml} = S_{ml} \cdot Nr \cdot (1 - [(100 - a_{ml})/100]) \cdot P^r_{ml},$$

$$E^r_{md} = S_{md} \cdot Nr \cdot (1 - [(100 - a_{md})/100]) \cdot P^r_{md},$$

in which: S_{ml}, S_{md}--industry wholesale price of ML and MD, in rubles;
Nr--number of republic computer centers in the system of the USSR CSA;
a_{ml}, a_{md}--percentage of reduction of consumption of ML and MD, respectively, at the republic computer center;
P^r_{ml}, P^r_{md}--number of ML and MD at the republic computer center.

Substituting the respective values into the formulas, we get:

$$E^r_{ml_{750}} = 53 \cdot 15 \cdot (1 - [(100 - 3)/100]) \cdot 1{,}151 = 27{,}451 \text{ rubles};$$

$$E^r_{ml_{375}} = 29.6 \cdot 15 \cdot (1 - [(100 - 3)/100]) \cdot 499 = 6{,}647 \text{ rubles};$$

$$E^r_{md_{29}} = 370 \cdot 15 \cdot (1 - [(100 - 8)/100]) \cdot 86 = 38{,}184 \text{ rubles};$$

$$E^r_{md_{7.2}} = 355 \cdot 15 \cdot (1 - [(100 - 8)/100]) \cdot 112 = 47{,}712 \text{ rubles}.$$

Thus the annual saving resulting from reduced consumption of ML and MD at republic computer centers is 119,994 rubles.

The total annual saving from reduced consumption of ML and MD was calculated similarly for oblast and city computer centers in the system of the USSR CSA.

The direct economic benefit is expressed in the reduced expenditure of magnetic media after the standard rates of consumption were put in effect.

7045
CSO: 1863/24

POPULAR SCIENCE PAMPHLET ON COMPUTER INSPECTION AND DIAGNOSIS

Moscow NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA RADIOELEKTRONIKA I SVYAZ (KONTROL I DIAGNOSTIKA EVM) in Russian No 10, 1986 (signed to press 5 Sep 86) pp 1-2, 64

[Authors' biographies, annotation, and table of contents from pamphlet "Computer Inspection and Diagnosis" by Boris Georgiyevich Sergeyev, candidate of engineering sciences, and Boris Moiseyevich Basok, candidate of engineering sciences, reviewed by G.Kh. Novik, doctor of engineering sciences, Izdatelstvo "Znaniye," 1986, 46,880 copies, 64 pages]

[Text] AUTHORS' BIOGRAPHIES

B.G. Sergeyev is laboratory chief at the Institute of Electronic Control Machines. His field of scientific interest is apparatus and methods of diagnostic inspection and building models of electronic hardware. He has written 35 scientific papers and is credited with 30 inventions.

B.M. Basok is senior scientific associate of the Institute of Electronic Control Machines. He is concerned with analysis and synthesis of inspection-diagnostic tests of digital devices and with developing software for general-purpose diagnostic equipment. He has published 30 scientific papers.

ANNOTATION

The pamphlet examines the apparatus for diagnostic inspection designed to ensure reliable functioning of present-day computer hardware--digital circuits, computer units, and large and small computer systems. It discusses the main problems facing developers of monitoring and diagnostic apparatus and the trends and prospects for development of this equipment.

The pamphlet is intended for engineers, lecturers, students, and teachers of people's universities and regular university students.

TABLE OF CONTENTS

7045
CSO: 1863/115

UDC 536.2+519.853.6

MATHEMATICAL MODEL AND THERMAL-ARRANGEMENT SYNTHESIS OF MULTICHANNEL SYSTEMS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 3, May-Jun 86 (manuscript received 18 Jan 84; after revision 15 Oct 84) pp 62-66

[Article by Yu.G. Stoyan, V.P. Putyatin and B.S. Elkin]

[Abstract] The task of thermal-arrangement synthesis of electronic devices is to minimize system dimensions by decreasing the dimensions of channels while preserving the proper internal structural order and maintaining limits as to maximum temperature. The approach suggested for solution of this problem is outlined using the example of a multichannel system, a body containing printed circuit boards on which are mounted discrete sources. Thermal-arrangement synthesis is reduced to a problem in nonlinear programming. An algorithm is presented for seeking an approximation of the local extreme of the goal function in this problem. The method suggested is intended for thermal-arrangement synthesis of one-off devices, to minimize dimensions while assuring required thermal conditions. Figures 3, references 11: Russian.

6508/12379
CSO: 1863/147

UDC 681.3.06

SOLUTION OF PLACEMENT PROBLEM BY SPECIALIZED AUTOMATED ELECTRONIC DESIGN SUBSYSTEM

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 3, May-Jun 86 (manuscript received 10 Mar 83) pp 66-71

[Article by V.M. Kureychik, B.K. Lebedev and V.V. Markov]

[Abstract] The basic parameters determining the specifics of solution of the placement problem include the model used to represent input information, solution criteria and the computation method. This article studies the principles of decision making in the computer component placement problem, questions of classification of placement methods and design of a placement subsystem which has all the properties of a more general design system but utilizes individual linguistic, mathematical and software facilities to optimize placement solutions. The placement algorithm suggested has been implemented as a program module. The input information includes a matrix of circuits, information on the hardware elements used and connections possible,

and technological limitations. The result of operation of the algorithm is a table of coordinates of the centers and orientations of modules on a board. Figures 2, references 3: Russian.

6508/12379
CSO: 1863/147

UDC 681.324:519.873

ANALYSIS OF FUNCTIONING OF COMPUTER MACHINES AND SYSTEMS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 21 Nov 85) pp 22-28

[Article by V.G. Khoroshebskiy]

[Abstract] Requirements which must be met by a method for calculating the quality characteristics of computers are noted, including applicability to systems with various numbers of machines, adequacy of stochastic models, uniformity of methods, simplicity of numerical analysis, and capability to determine general quantitative characteristics. A set of indicators is analyzed which describes the functioning of machines sufficiently completely and defines the basic features of a methodology for analysis of the operation of multiple-machine computer systems. The characteristics define the reliability, survivability, capability to perform the task at hand and technical-economic effectiveness of functioning of computer systems. The computational methods suggested can be used regardless of the number of processors in a system. References 8: Russian.

6508/12379
CSO: 1863/141

UDC 681.325.5

COMPUTER SYSTEMS BASED ON BIT-BY-BIT INTERPRETATION OF PROCESSED INFORMATION

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 3 Jan 86; after revision 3 Feb 86) pp 33-40

[Article by V.F. Yedokimov and A.I. Stasyuk]

[Abstract] Analysis of existing computer systems indicates that the potential capabilities for relative increases in computational speed can best be found in parallel processing at the level of the digits representing information. Mathematical models must be represented so that each variable corresponding to

a given position in the model is represented by an analytic expression. Synthesis of an electronic model reproducing the value of each digit thus formed and interconnection of all the models yields a computer system performing parallel computation of each bit of the vector of unknowns. Organization of such a system requires development of methods of bit-by-bit interpretation of mathematical models and a mathematical apparatus for their description; principles of parallel computer processing at the bit level; methods of forming analytic equations determining the digits of the vector of unknowns in an initial mathematical model; a method of synthesizing computer models of the values of the digit variable; bit-structure synthesis of homogeneous functionally oriented computer systems; and principles of quasi-dynamic modification of computer system architecture. This article formulates a number of definitions and statements for use in the process of synthesis of such systems. By modeling macro operations, the method here suggested allows an increase in the level of a machine language, essentially simplifying the process of programming for such systems, significantly increasing speed by achievement of parallel operation of bit computations, implementing any method of information processing simply. It will allow synthesis of computer systems by a single method based on bit-by-bit interpretation of mathematical models. Figures 4; references 10: Russian.

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UDC 621.313.13

PROBLEMS OF CREATING MAGNETOELECTRIC ACTUATING ELEMENTS WITH MAXIMUM SPEED

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 21 Nov 85) pp 64-69

[Article by V.V. Petrov]

[Abstract] The speed of a magnetoelectric system refers to the maximum acceleration with which it can move a certain mass consisting of the mass of a conductor of the magnetoelectric system in the magnetic field and the attached mass, consisting of the mass of the useful load and the remaining moving elements of the magnetic system. The variation in speed of such magneto-electric mechanisms is studied as a function of selection of the conductor material for various external loads. The analysis indicates the desirability of using a number of light metals in high speed magnetoelectric systems. Only four methods have sufficiently high melting points to be considered in practice: Beryllium, calcium, aluminum and magnesium. The maximum speed was achieved by lithium, which is accelerated seven times more rapidly than copper under normal conditions. Binary alloys could significantly expand the list of suitable metals for such purposes. Figures 3, references 3: Russian.

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CSO: 1863/141

UDC 681.3.06

TUNABLE SYSTEM FOR PROGRAMMING MICROPROCESSOR MODELING COMPLEXES

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 3, May-Jun 86 (manuscript received 5 May 84; after revision 27 Dec 84) pp 18-21

[Article by A.A. Menn and V.G. Speranskiy]

[Abstract] A programming system is analyzed, designed to adapt the assembly code translator of a specific microcomputer. The first experimental version of the system was tested by adapting PAL-11 and MACRO-11 assembly code for the "Elektronika=60" and "Elektronika-60M" computers; ASM-86 for the INTEL-8086, assembly codes for the Motorola 6800 and YeS computers, as well as the creation of new languages, including programming languages for specialized computers based on microprocessor chip sets. The advantage of the proposed programming system structure is that the functions of preprocessors become more local. They operate with a narrowly specialized language and need not consider many peculiarities of the input language. Figures 2, references 9: 7 Russian, 2 Western.

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UDC 681.306:519.68

DIALOGUE MODELING SYSTEM FOR DISCRETE DEVICES WITH DEFECTS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 3, May-Jun 86 (manuscript received 2 Apr 84) pp 25-29

[Article by S.V. Yenin and A.I. Filatchenkov]

[Abstract] The DIANA-1 system models the behavior of a device with or without defects in response to a fixed sequence of input signals and analyses modifications in the device resulting from the appearance of defects. The system also analyzes the structure of the device being modeled, dividing the

circuit into memory and combination portions, ranking and constructing a list of feedback connections. The analysis process divides the fixed set of possible defects into classes of functionally equivalent defects, each of which can be replaced by a single representative defect. The objects analyzed are synchronous discrete devices consisting of elements whose behavior can be described by a system of boolean functions. The structure and use of the DIANA-1 system are described. The modeling system can analyze the behavior of a network consisting of some dozens of functional units, each of which contains some dozens of MSI microcircuits, in response to as many as 500 input signals in a few minutes on a YeS-1060 computer. References 10: Russian.

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UDC 681.324

THE CONCEPT OF DESIGN OF A DIALOGUE MODELING SYSTEM AND ITS IMPLEMENTATION

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 29 Dec 85) pp 28-32

[Article by A.G. Dodonov, V.G. Klimenko, A.V. Polishuk and A.M. Yarmolenko]

[Abstract] Analysis of developmental trends in modeling and the development of prospective modeling system architectures require the development of modeling languages, a continuing process. Difficulties with present modeling languages include inability to use easily available hardware, cumbersome syntax, poor diagnosis of errors, consumption of extensive computer resources, and unfriendly user interface. An architecture is suggested for a multi-language dialogue modeling system which can use existing hardware and can be implemented in a distributed environment. The dialogue modeling system is called DISIM, and includes a dialogue processor, modeling system and knowledge-base system functioning under the control of the DISIM kernel. The first version of DISIM runs under OS YeS in MVT or SVS mode on YeS computers with at least one MB memory. Experiments with version one have shown that it is a convenient facility for machine experiments on modeling of computer networks. References 19: Russian.

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CSO: 1863/141

COMPUTERS AT THE SERVICE OF INSURANCE

Alma-Ata NARODNOYE KHOZYAYSTVO KAZAKHSTANA in Russian No 8, Aug 86 pp 29-32

[Article by K. Zhuyrikov and G. Kim, honored economists of the Kazakh SSR: "Computers at the Service of Insurance"]

[Text] Computerized recordkeeping of insurance information is assigned an important role in the development of insurance at the current stage, in more stringent monitoring of the preservation of government funds and in improving the services for the population and farm enterprises.

The first stage in machine information processing dates back to the 1960's, when desktop calculators gave way to punch card computers [PVM]. They came to be used mainly for mechanized recordkeeping of premium payments under contracts of voluntary mixed life insurance, because this particular form of insurance constituted the bulk of operations of Gosstrakh [Chief Office of Government Insurance of the Ministry of Finance of the USSR] at that time.

In the 1970's, as insurance in the Kazakh Republic continued to grow at a rapid pace, the volume of incoming accounting and economic data increased. Since that time the industry introduced into operation electronic computers which helped automate insurance operations, combine and organize data and reduce the proportion of manual work.

Initially, the insurance agencies did not have their own hardware and had to utilize the services of the computer center of TsSU [Central Statistical Office] of Kazakh SSR. Projects for computerized processing of insurance information were developed at the center for Minsk-22, Minsk-32, PVK M-5000 and ES computers.

The projects included computerized processing of life insurance transactions, which accounted for the largest proportion of operations among other types of insurance.

In the 1980's a management automation system for government insurance began to be developed [ASU-Gosstrakh]; the priority problems for the chief administratrion of Gosstrakh of Kazakh SSR were the first to be computerized. At the same time, the scope of functions performed on computer for Gosstrakh inspectorate was expanded.

Enlisting the aid of computer technology was a practical necessity. This is obvious from the data characterizing the amount of work performed by the government insurance agencies. For example, the planned premiums on all forms of insurance in the 10th Five-Year-Plan period grew as compared with the Ninth Five-Year-Plan period by a factor of 2.5, including a 2.7-fold growth of the proceeds of voluntary insurance.

Another premise for computerization was the regulation setting the time schedules for data processing.

The first step in accomplishing these tasks is preparation of primary data. Documents to be used in the performance of functions included in the project are filled out and forwarded to the computer center (CC). The input information for the computer is encoded with the aid of several codes; each feature is assigned an alphabetical or numeric code.

To prevent errors the input of information into the computer at the CC includes compiling a table of protective codes for personal accounts entered into the computer. This ensures that the premiums received will be credited only to the account of the particular policyholder.

The correct execution of input documents used as a basis for computer printouts is crucial.

The following operations in life insurance are currently performed by Gosstrakh agencies on a computer: keeping personal accounts; making excerpts from personal accounts and estimating surrender values; keeping record of policy contracts, premiums and totals in life insurance; compilation of inventory lists of contracts and dates they are taken out; monitoring correct calculation of premiums and their timely receipt; and compiling lists of policyholders whose premiums are deducted automatically from their paychecks.

Computer processing of data includes an automatic compilation of policyholder accounts at Gosstrakh agencies. Lists of current life insurance policy contracts are prepared, specifying the data for each policyholder. These lists, which are called proofs of personal account files, are prepared in a certain format.

After the proofs are verified, they are put together into batches, separate for each insurance agent, and with an appropriate label forwarded to the CC. At the computer center the information from the proofs is put onto machine carriers according to a certain format (punch cards, punch tapes, magnetic tapes and magnetic disks) and entered into the computer. The results of machine verification are produced as "a record of input errors" and "a register of entered contracts." The input of information into the computer involves an automatic verification of the numbers of personal accounts as filled in by the insurance agents; protective codes are used for this purpose.

The data from personal accounts after machine verification are entered into the verified file, which is then updated as new contracts are entered or cancelled upon expiration, transfer to other agencies, surrender, etc.

The computer center also receives information for correcting errors in the input forms detected by the computer. The filled-out documents are sorted into batches. Each is provided with a cover invoice, indicating the code of the form, the number of the batch and the registration date. The document batches are forwarded to the CC in accordance with a preapproved schedule.

The data processing programs at the center produce the following documents in the life insurance area: balance statements of personal accounts, portfolios of contracts sold by an insurance agent, information on the number of contaracts and premiums, inventory lists of contracts and lists of policyholders for automatic premium deductions from payrolls.

It should be emphasized that currently computerized information processing is in place in all oblasts of Kazakhstan.

As of 1 Apr 1986, the computer center served 78 insurance agencies subordinated to Gosstrakh.

The volume of policyholder accounts in the life insurance area processed on a computer amounted to 1,195,700, i.e., 36.9 percent of the total. Of these, 83.3 percent were processed on the basis of the computer facilities of CC of TsSU of Kazakh SSR and 16.7 percent at the Information-Computer Center of the Ministry of Finance [IVTs Minfin] of Kazakh SSR.

In 1985 alone, 123,400 policies were converted to computer form, which was 102.8 percent of the planned target for that year.

Best results in computerization have been achieved by the insurance agencies of East Kazakhstan, Mangyshlak, Dzhambul, Karaganda and Tselinograd oblasts.

From May to September of 1984, all 11 insurance agencies of Gosstrakh in Alma-Ata completed the transfer of 190,000 accounts from the hardware base of TsSU to an identical base at IVTs Minfin of Kazakh SSR.

The use of the computers at this center will make it possible to perform automatically the crediting of premiums and to provide status reports at any date on request of the agency. All these measures are aimed at improving services for the population.

Automatic compilation of lists for remittance of life insurance premiums deducted from payrolls has saved our agents time for signing up new policies and has greatly reduced the number of errors which were frequent when the lists were prepared manually.

In addition, computers make recordkeeping easier and faster, raise productivity and improve service quality. The reduction of manual operations has decreased the time spent by accountants and inspectors for carefuly auditing

the documents filled out by the agents and for monitoring the integrity of government funds.

The growth of the amounts of premiums and payments of surrender values and claims leads to a substantial increase of the volume of incoming information every year. This made it necessary to reduce the proportion of work done manually by our employees.

In view of the launching of the priority functions of ASU of Gosstrakh and the IVTs Minfin of Kazakh SSR, the Chief Administration of the Government Insurance Agencies of Kazakhstan discontinued the manual preparation of regular current reports on premium payments (form 1-GS), the reports submitted every 15 days to the senior officials at the Ministry of Finances and two other directive agencies of the republic. Computers have also been charged with preparing report forms 5-GS, "On Payment of Claims and Surrender Values" and analysis of these forms; form 4-GS, "On the Results of Evaluation of Insurance Payments in Collective and State Farms and Private Households," the actuarial analysis tables based on these data and cumulative quarterly and annual recordkeeping and annual reporting on operations in the government insurance sphere.

The computerized systems at the Chief Administration of the Insurance Agencies have greatly reduced the amount of manual work and made it possible to retain a number of employees while expanding the volume of work. In particular, while the employment in insurance agencies remained virtually unchanged since 1980, the number of policy contracts among the population has grown by 15 percent.

The first experience with computerized data processing in preparing reports on premium payments (form 1-GS), the analysis of the results of premium evaluation in collective farms and compilation of cumulative reports (form 4-GS) dates back to 1980. By 1981 the Information-Computer Institute of the Ministry of Finances already produced information on the fulfillment of plan insurance payments and reports (form 4-GS), the results of a census of objects of mandatory insurance and estimates of premium payments by collective and state farms and private households.

The Information-Computer Institute has developed a comprehensive set of tasks in processing of reports based on form 4-GS, accumulation and analysis of reports according to form 1-GS, form 5-GC, quarterly bookkeeping reports, annual bookkeeping reports and annual reports on operations in the government insurance sphere.

Starting in 1986, a project of computerized maintenance of mandatory insurance of private property has been put into effect. This adds urgency to allocation of sufficient computer time for Gosstrakh at the Computer Center of TsSU of Kazakh SSR.

The current status of operations at government insurance agencies and official statistics on further expansion of computerization and accounting in the insurance area is discussed regularly at meetings of senior experts

at the Ministry of Finance of Kazakh SSR and TsSU. A republic-wide seminar has been held in Alma-Ata on industrial-scale introduction of the Moscow project "ASU-Mathematical Software Inspection" and a set of programs on conversion of information bases from Minsk-32 to ES computers. In Pavlodar information processing operations have already been switched from Minsk-32 to ES computers; in the other oblasts the conversion is planned for 1986-1987.

The core software for the ASU of Gosstrakh and Information-Computer Center is the Istra [Interpreting System of Tabulated Estimates] package, intended for automation of programming for the solution of economic problems.

The software package consists of algorithmic, programming and linguistic components intended for the processing and printout of information in cumulations and groupings of primary economic analysis data.

The characteristic of the Istra software package is the possibility it provides for bringing all the tasks into a comprehensive system. Data received from subordinate government insurance agencies (from oblasts and republics) are transferred to a machine-readable medium (punched cards and tapes) directly from the forms and analytic tables. The data are then stored in the computer for subsequent uses.

The main indicator of the system performance is the reliability of output data. It is achieved not only by preliminary control at the input stage but also by monitoring based on algorithms describing the interaction of requisites inside and between the documents. After the testing, additional processing of tables can be performed to generate cumulative tables; in case of errors an appropriate message is produced.

The main goal of developing the ASU-Gosstrakh system is to improve the efficacy of managing the government insurance agencies and achieve more efficient procedures, improve reporting quality and create the appropriate information base for well-substantiated current economic decision-making, reduced labor and time costs of report preparation and streamlined organizational structure of insurance agencies.

The next step in the utilization of computer facilities in the system will be introduction of computational and microprocessor technology, computerized control systems and remote communication facilities.

For the fulfillment of long-term development plans of the insurance services, further improvements in the system of management and higher productivity of employees will be necessary. In order to keep the managers of insurance agencies and computer centers informed of the latest developments, the Chief Administration of the Government Insurance Agencies of Kazakh SSR, in a joint effort with Kazakhmashinform [Kazakh Board of Mechanization of Information Work] of TsSU of the republic and the Information-Computer Institute of the Ministry of Finances of Kazakh SSR, regularly conduct all-Kazakhstan conferences and seminars.

However, managers of some of the agencies in our system fail to pay sufficient attention to introduction of computerized information processing or to take the required steps to meet the planned targets, which is a result of their failure to properly understand the issue of automated recordkeeping. While the overall plan for Kazakhstan for 1981-1985 was completed as of 1 Jan 1986 to 100.4 percent, in Guryevsk oblast the plan assignments were fulfilled to just 74.4 percent; in Semipalatinsk oblast 79.3 percent and Pavlodar oblast to 86.7 percent.

It is not infrequent that insurance agencies which have launched computerization of information processing fail to provide the proper supervision of this aspect of work. As a result, complete information processing is not achieved. In addition, Guryev and Turgay city insurance agencies, Uralsk industrial district and other agencies failed to enforce the timely submittance by the agents of lists of policyholders with direct deposit of payments; these documents were not supplied to the computer center in due time, leading to failures in meeting the deadlines of computerized document processing. There are also frequent cases of incorrect or sloppy filling-out of input documents.

One has to state also that some agencies use computers to process only bills and payments of premiums performed by noncash clearing, while bills paid in cash are still processed manually.

The computerization of operations is still at a very low level in the following oblasts: Uralsk (2.5 percent), Guryev (14.8), Turgay (9.9) and Semipalatinsk (22.9), while, on average, for Kazakhstan the figure is 36.9 percent.

A large part of the blame lies with unpreparedness of CC for information processing. In Uralsk oblast, for example, where the first steps in computerized planning were made in 1981, the scheduled time of conversion to computer has been postponed from year to year because of difficulties with the launching and operating computers at the computer center of Uraloblmashinform [Uralsk Oblast Organization for Computerized Information Processing], until it was finally postponed to 1985. As a result, while for the 11th Five-Year-Plan period 25,000 accounts were supposed to be converted to computer, only 2100, or 8.4 percent, were actually computerized as of 1 Oct 1985.

An acute and still unresolved problem for Kazakhmashinform is the supply of magnetic disks type R421 to computer centers equipped with VKM-5010 and VKM-5100 computers. For example, the Dzhetygarinsk Computer Center in Kustanay oblast had to run the system on low-quality disks, which resulted in damage to the entire information base of the insurance agency, including more than 15,000 life insurance policyholder accounts.

The situation is similar at the Computer Center of Semipalatinsk oblast Computerized Information Institute, where disks R414 were used to process information of insurance agencies, which resulted in higher costs and failures to meet processing deadlines. The data of 36 insurance agencies in eight oblasts are processed on obsolete and worn-out Minsk-32 computers.

Frequent breakdowns of the computer at Dzhambul and Kaskelen Computer Centers of Alma-Ata Oblast Board of Mechanized Information Work failed to secure timely processing of data.

Permanent computer time shortages in the season of annual statistical reporting (from January to April) typically prevent the computer centers of TsSU of Kazakh SSR from meeting their obligations under contracts, disrupting the computerized data processing schedules. This is the season when the largest number of complaints and claims criticizing the operation of computer centers are received.

These and other shortcomings eventually interfere with providing timely services to the population and result in additional spending of funds.

Since automated management systems based on up-to-date computer technology and various information transmission and organization facilities offer a potential for performing new and more sophisticated functions, including the projections and optimum planning of government insurance activities in Kazakhstan, joint efforts are needed for a speedy elimination of the existing shortcomings.

9922
CSO: 1863/60

SOCIAL SCIENCE INFORMATION BASE

Tbilisi ZARYA VOSTOKA in Russian 30 Mar 86 p 4

[Article: "The Data Bank: A Compass in the World of Ideas"]

[Text] A storehouse of information on 300,000 books, articles, and pamphlets over the entire range of the social sciences is only a telephone number away. The data bank is located in Moscow, and the video display terminal requesting a dialogue with the computer is in Tbilisi. This is the kind of information bridge that has been built by the specialists who have developed and introduced the first phase of the republic automated system of scientific information in the social sciences known as RASNION "Georgia."

Nelli Okruashvili, laboratory head of the Center for Scientific Information in the Social Sciences [TsNION] of the Georgian Academy of Sciences, is at the terminal. A GRUZINFORM correspondent was also there and became a participant in one of the sessions of what is known as long-distance teleaccess provided by an intercity telephone line.

"Type in the name of the information base," says the green line running across the screen. We choose "Bibnov"--which stands for new bibliography, i.e., one that has been compiled in the last 3 years.

"Make a request," the machine immediately suggests.

"Discipline," I give as a key word or, as they put it here, as the topic tag, and I see the response: 120 documents. This means that there is information on the problem indicated from that many items stored in the computer.

We type the command "Display" and the screen shows the "calling cards" of the items, annotations reflecting the main idea. Here again the computer takes into account the possibility of selection. It presents two aspects of the term: discipline as a subject matter, as a field of knowledge, and discipline as a standard of behavior. For example, work discipline and its role in achieving success in socialist competition.

Now if you press the key "Print," a special device will print out the data collected and processed 2,000 km away in the exceedingly abundant data bank of the Institute for Scientific Information in the Social Sciences of the USSR Academy of Sciences.

"According to preliminary estimates, an hour of the computer's operation is equivalent to nearly 7 workdays when an ordinary search is made in card files," remarks Nodar Irakliyevich Kikvadze, director of TsNION. "But it is not just a question of a rise of labor productivity, but also of a change in the character of labor. In essence we are talking about creating a new information environment in which we will live and work even in the quite near future. This is directly related to performance of the tasks set by the 27th CPSU Congress to invigorate the ideological effort. In the policy report to the CPSU Central Committee the campaign of the ideological offensive of bourgeois propaganda which has now been unleashed is referred to as a "special form of aggression, information imperialism." Taking that into account, in our work we have been striving to provide extensive aid to specialists in conducting counter-propaganda activity and have ourselves been actively conducting research in that direction.

Data are already beginning to be stored in the computer on the materials of the congress. As they are accumulated, they will be represented in abstract publications.

Even now scientists, VUZ professors, and officials of party and state bodies and agencies are turning to RASNION for help. The requests of lecturers and propagandists are also taken into account, and by the end of the 5-year period it will be possible to serve secondary school teachers and even students. After all, the automated system, which incidentally is the third in the country, has been built on the scale of the republic and operates in an interactive mode. It not only receives data from Moscow, but indirectly from Bulgaria, Hungary, the GDR, Poland, Czechoslovakia, and even by satellite from far-off Cuba, but it builds up the data bank itself.

"Thanks to this synthesis of the computer and the social sciences information is being turned into a most important resource of the state, and the sphere of its circulation is being turned into one of the dynamically developing sectors of the economy," V. Gugushvili, deputy director of TsNION and one of the system's designers, emphasized. "In connection with the beginning of large-scale computerization, in our republic specifically, the question of what kind of support will be given to this sphere in both technical and ideological terms is becoming an urgent one."

The official's uneasiness is quite justified. This is a good place to cite a paradoxical example from the life of the center itself. There is only one telephone in an organization in which more than 100 people work. The connection to Moscow also runs over that line. The promises of the republic's communications ministry which have been made for many years that it would deal with this matter have remained a dead letter. Voluminous correspondence has become a bureaucratic barrier pure and simple, and even electronic information that does not use paper is unable to overcome it.

And so it covers the road from Vaka, where TsNION is located, to Saburtalo, where the Computer Mathematics Institute is located, by car. This is the way the magnetic tapes are delivered so that the material prepared by the information specialists can be stored in the computer. Moreover, they rent computer

time only on days off and at night--that is the only alternative. Why? The communications channels have not been adapted to present-day operating conditions, and they are not equipped with devices to connect the volume user to the computer. A figurative comparison is inescapable: the situation is like building a high-speed highway in which the traffic consists of two-wheeled carts....

"Now that the USSR State Committee for Computers and Informatics has been created, many of the questions of technical support will be dealt with centrally and responsively," V. Gugushvili said. "This makes it all the more important to begin even now to accumulate information--of a political nature, on science and culture--in the republic. It must be collected and sorted here locally."

The creation of automated information banks is to proceed so that in 5-8 years, when computer networks in the republic become reality, a virtually immediate answer can be made to any question from a teacher in a rural school, a propagandist, or the work force of a plant shop....

The view of the people in the center is that the time has come to create a comprehensive republic system of automated data banks, and at the same time to prepare specialists who can channel the flow of electronic information to the right address. Today that flow contains an immense strength for having an impact and constitutes an immense value.

...A curious detail sticks in the mind. The dialogue with the computer begins with the greetings customary in human conversation. But if it is to give access to its treasures, the computer must be convinced that you are someone who is trusted. And it demands: "Password." The magic word typed on the keyboard of the terminal does not appear on the screen. This is the key to the greatest wealth of the people--its knowledge and memory. A key that cannot be passed from hand to hand.

7045
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ESTIMATION OF ECONOMIC EFFICIENCY OF AUTOMATION

Moscow VESTNIK STATISTIKI in Russian No 7, Jul 86 pp 44-48

[Article by N. Ivanov, candidate of economic sciences, department head of the Collective Use Computer Center of Glavmosmontazhspetsstroy, and L. Yampolskaya, senior engineer, candidate of economic sciences, VNIPIuchet [All-Union Scientific Research and Design Institute for Accounting and Recordkeeping]]

[Text] Improvement of management is taking on great importance in the context of the USSR's intensive economic development. Broader use needs to be made of computers in making optimum management decisions. But processing economic information with computer equipment requires major outlays, and this imparts greater importance to sound appraisals of its purposive and efficient use.

Efficiency, along with other indicators, is also estimated from the standpoint of improvement of the economic performance of whatever is being automated. The relevant indicators are calculated at the present time on the basis of the methods for determining the efficiency of use of new technology and ASUP. Experience has shown that the following changes may be achieved in the functioning of the production facility when the processing of information is automated: reduction of losses of labor resources and idle time of equipment for organizational reasons by 30-40 percent, reduction of consumption of physical resources by 0.5-1.0 percent, reduction of additional payments for overtime by 25-30 percent, a growth of output by 0.5-1.5 percent, reduction of losses caused by rejects by 15-20 percent, reduction of unproductive costs by 25-30 percent, and reduction of the need for working capital by 1-2 percent.

In accordance with the existing methods economic efficiency is calculated in stages: studies are made of the facilities whose management is to be automated, the factors involved in formation of the economic benefit are determined, and the indicators of enterprise performance and indicators of economic efficiency are calculated.

The complexity of evaluating the influence of the automation of data processing on the production and economic performance of the entity (indirect saving) and attempts to eliminate the influence of factors not related to the process of automating management have led to the development of a number of methods that make it possible to single out that share of the benefit which resulted from automation of management.

Investigation of the capabilities of these methods and analysis of the authenticity of the representation of the actual results of the operation of automatic data processing systems have shown that it is best to use the method of computation based on problem-by-problem estimates of the saving. The reason for this is that an automatic data processing system is introduced as a rule in stages, so that the benefit should also be viewed in conformity with the sequence in which problems are included, with due consideration paid to their volume characteristics. This method makes it possible to determine most reliably the size of the indirect saving on the basis of a statistical study of functioning systems for automatic processing of bookkeeping data. Automation of the processing of accounting data and improvement of managerial operations on that basis contribute to improved efficiency in the economic activity of enterprises and afford the possibility of activating untapped potential.

It is advisable to measure the influence of automatic processing of accounting data on the efficiency indicators in the performance of the entity automated with respect to the factors and the sources of the saving. That is in fact why the attempt was made to determine the factors and sources of the saving for each problem. But the diversity of problems in accounting does not allow for distinguishing the sources of the saving in strict accordance with these problems. For instance, outlays for raw materials and supplies are reduced when the set of problems is solved in keeping records on stocks and movement of inventories in quantitative and value terms in a product-by-product rundown, on the movement of physical units in value terms from one structural subdivision, account, subaccount, inventory group, or corresponding account to another, when operations pertaining to accounts are summarized, and so on.

The saving on the wage fund of personnel resulting from automation of data processing occurs through the operation of a number of factors--optimum use of worktime, elimination of unproductive worktime losses and idle time lasting less than one shift, by improving the quality of the output quotas in effect, etc. The effect of each of these is related to the solving of several problems. For instance, in order to discover such factors as optimum use of worktime and elimination of unevenness in the pace of production one needs to analyze information obtained in solving such problems as calculations related to figuring piece-rate and time-rate remuneration, distribution of wages among those who work in the brigade, calculations involved in figuring wages for overtime, idle time, and so on.

Moreover, the dependence in the opposite direction (between the solution to the problem and the source of the economy) is not unambiguous either. For instance, the information obtained in solving the problem of calculating depreciation totals makes it possible to monitor the updating and retirement of fixed assets, to increase their active portion, and to justify the need for those assets.

An analysis of the sources and factors of the saving resulting from automation of data processing affords the possibility of concluding that one and the same factor exerts an influence on various indicators of economic performance and is effected through the problems of bookkeeping.

Quantitative measurement of each factor's influence and localization of the share of its influence within the limits of each accounting problem necessitate extremely complicated calculations. In addition, certain factors and sources of saving are not subject to quantitative estimation. For instance, it is not possible to measure the influence of such factors as systematizing the set of standards, quotas, and standard allowances and updating it on an ongoing basis, eliminating causes of irregularity in the pace of production, or the introduction of scientific management; it would be difficult to overestimate the influence of these factors. An investigation of the correlation between the factors in the saving resulting from automation of the processing of accounting data with the sources of the saving and the principal indicators of the economic performance of the entities automated has demonstrated the multifariousness of their relationship to the indicators of economic performance.

In order to determine problem-by-problem estimates of the economy achieved in automating the processing of accounting data we need intensive and comprehensive studies of the entities being automated, complicated economic-statistical calculations related to classification, to discovering trends, and to forecasting the basic economic indicators, and so on. That is why an experimental test was made of the problem-by-problem estimates worked out by NIIUMS [Scientific Research Institute for Computers and Computer Systems Used in Management and Control]. (Footnote 1) (I.Ya. Kruchinin, V.Kh. Lev, and V.F. Tynyankin, "Problem-by-Problem Estimates of the Economic Efficiency of an ASUP," PRIBORY I SISTEMY UPRAVLENIYA, No 1, 1983, pp 43-45)

Problem-by-problem estimates demonstrate the degree of influence of each problem of the ASUP on the indicators of the production and economic performance of the entity being automated. These estimates are indispensable in view of the absence of a set of standards in the materials on methods for determining the economic efficiency of an ASUP. The basis for constructing the problem-by-problem estimates is the statistical processing of data on the economic efficiency of functioning ASUP and expert evaluations of the degree of influence of the problems on the indicators of an industrial enterprise's operation. Here the role of expert evaluations was limited in that it was not the degree of influence of the problems on changes in the respective performance indicator of the enterprise that was determined, but rather the results of the functioning of the ASUP were ranked with respect to the problems influencing the respective component of the saving. The problem-by-problem estimates were determined by comparing economic performance with the ASUP (the comparison variant) with a scientifically sound forecast of the same indicators without it (the base variant). The indicators of the base variant are adjusted for the year of the system's introduction in order to record their change by virtue of improvement of production. Stable proportions, relationships, and dynamic behavior of the basic indicators of the enterprise in previous years were found for this purpose. For instance, average annual growth rates of output per worker, of the volume of production, and of the average wage were calculated, as were indicators of the reduction of production cost, reduction of worktime losses lasting less than one shift, remuneration of overtime work, idle time, unproductive expenditures to pay penalties, reduction of the specific rate of consumption of raw materials and supplies, etc.

The problem-by-problem estimates were worked out for the purpose of sound determination of the percentage of reduction of the elements of the production cost and unproductive outlays resulting from automation of data processing.

These estimates were obtained in connection with a survey of enterprises with a particular type of production operation and with the following average characteristics: annual volume of sales--about 40 million rubles, average size of the work force--3,500, value of fixed productive capital--22 million rubles, and value of working capital subject to standard allowances--6.6 million rubles.

The coefficients computed were extended to those enterprises in various branches of industry in which the mechanized processing of accounting data had not been going on for at least 3 years. During the experimental survey comparisons were made of the total annual saving obtained using computations called for in the method of the ASUP and that obtained with the problem-by-problem estimates.

A comparison of the size of the annual saving obtained by the different methods showed substantial discrepancies between the calculated (by means of the problem-by-problem estimates) and the actual saving (calculated according to the method of the ASUP). For instance, for machinebuilding enterprises in light industry and the food industry the deviations amounted to 60 percent or more, for those in the food industry they ranged between 30 and 70 percent, and for those in the USSR Ministry of Industrial Construction they ranged from 11 to 50 percent.

We should note in this connection that when comprehensive automation of accounting was introduced the actual size of the saving showed the maximum divergence from the calculated size. This size was minimal in certain areas of accounting. For instance, for machinebuilding enterprises in light industry and the food industry the deviations of the size of the calculated saving from the actual saving were as follows: when the processing of data on the keeping of records on fixed assets was introduced--6.9 percent, but when comprehensive automation was introduced--74.3 percent; for enterprises in the food industry the respective figures were 17.2 percent (records on annual output) and 70 percent.

These discrepancies might have resulted from differences in the method of determining the benefit or differences in the size of the entity being automated.

When a comparison is made of the size of the enterprises being compared with that of those taken as the "standard" and the size of the saving is extrapolated in accordance with this indicator, still larger discrepancies were observed. The fact that the calculated size of the annual saving was greater than the actual saving, which as a rule was calculated on the basis of the method for determining the economic efficiency of an ASUP, shows that the recommended estimates of the saving were too high.

An analysis of the figures on the sizes of the calculated and actual saving made it possible to conclude that the recommended estimates of the saving were

unacceptable for determining the benefit achieved in automating accounting records because when they are used the total size of the annual saving runs substantially on the high side. Consequently, additional studies are needed to calculate coefficients of the economy that would authentically reflect the results of introducing automatic processing of accounting data.

As we have already pointed out, the diversity of the problems of accounting does not afford the possibility of representing the sources of the saving in strict accordance with the problems of accounting. Nor has the problem been worked on of establishing linkages between sources of economic efficiency and the problems that bring them about. The reason for this is that several sources are effected at one and the same time in solving many problems, so that an interrelated set of problems has to be solved to take advantage of most of them. For instance, in studying the correlation between the sources and factors of the saving and the principal indicators of the performance of entities being automated we discovered the simultaneous influence of a large number of factors on several indicators. This accounts for the complexity and frequently even impossibility of quantitative measurement of this process within the confines of a single problem. It seems advisable, then, to calculate the saving by areas of accounting (rather than by problems) in the form of the percentage of reduction of the relevant item or element of the production cost. This procedure for calculating the estimates of the saving is related to the introduction of automatic processing of accounting data, since as a rule it is the accounting department that is being automated. The existing accounting areas are related to the items (elements) of the production cost.

Accounting Areas	Production Cost Items (Elements)
Inventories	Raw materials and supplies Fuel and energy for manufacturing purposes
Labor and wages	Wages of basic production personnel
Working capital	Costs of preparing production operations and bringing them up to rated capacity Costs of maintenance and operation of equipment
Production costs	Shopwide costs Plantwide costs Losses from rejects Other production costs
Financial and settlement operations	Nonproduction costs Penalties, fines, and forfeits paid, not included in the production cost

Since standards are necessary to calculations of the anticipated saving, that is, since they must be consolidated, the estimates of the saving must be calculated by accounting areas, rather than by problems. This is all the more indispensable because one and the same problems may pertain to differing areas

of accounting work in different enterprises. Posing the problem this way makes it possible to avoid double counting of the size of the economic benefit resulting from mechanization. Integrated solution of the problems of accounting in order to attain maximum effectiveness provides indirect evidence of the need to calculate the estimates of the saving by accounting areas (rather than by problems).

Thus calculation of the estimates of the saving by production cost elements and items fits in with the existing areas of accounting and with the introduction of automatic processing of accounting data.

The coefficients (estimates) of the saving by production cost elements and items obtained as the result of the computations will be consolidated, and therefore it is feasible to use them for calculations of economic efficiency in the stages of technical-and-economic substantiation and preparing the detail (detail-contractor) and contractor design.

At the present time the problem of estimating the efficiency of introducing computers for statistical recordkeeping in the sectors of the economy is becoming ever more urgent. An analysis of the methods proposed for measuring the efficiency of introducing automatic data processing systems has made it possible to conclude that standard estimates of the saving need to be worked out by accounting areas, since the use of these estimates will also make it possible to evaluate more objectively the indirect benefit from mechanizing accounting computations. Accordingly, to determine the economic efficiency of introducing automation it is most advisable to use a method whereby it is possible to calculate the overall efficiency as the sum total of economic benefits from introduction of each area of mechanized accounting.

To create such a method we need an extensive survey of enterprises and organizations in which automated (mechanized) processing of accounting data has been introduced. On the basis of actual data on their economic performance before and after mechanization of accounting and computations it is possible to calculate estimates of the saving by accounting areas in accordance with the method set forth in the article. (Footnote 2) (Ibid.)

The estimates of the saving worked out in this way make it possible to measure the real benefit from automation of accounting computations and also to select the optimum procedure for introduction of the problems (areas) of accounting in order to minimize the costs and maximize the benefit.

7045
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CAD PROGRAMS DEVELOPED

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 11, Jun 86 p 3

[Article by V. Kaner, engineer, Leningrad: "The Computer as Codesigner"]

[Text] Computerization of design work has begun in the Leningrad VPTIenergomash.

Specialists figure that today a designer spends only 10-15 percent of his worktime on the creative search for the solution to the technical problem that he has been set. The rest of the time goes to collecting and analyzing information, to various computations performed with ready-made formulas, and to the approval and drafting of documents. The first steps have been taken at Leningrad enterprises and in the organizations of power machinebuilding to apply a new design technology in which the engineer's routine work is done competently and on time by electronic systems.

Drafting and graphic work is the most time-consuming part of preparing a design. It accounts for as much as 50 percent of all the inputs of labor. That is why at the All-Union Design Technology Institute for Power Machinebuilding (VPTIenergomash) the first assault upon routine in the designer's work began in precisely that area: an automatic machine began to perform 35 types of drawings of production jigs and fixtures for machining turbine blades. It confidently moves its pen over the drafting paper, sketching the outline of the part, making the necessary cutaways and cross sections, and placing the design notation and production instructions in the blank areas of the drawing. The automatic machine does all this quickly and accurately, adhering to the dimensions and even to the thickness of the line it draws. And a computer performs the actual process of designing the jigs and fixtures, that is, of selecting the technical design from among the standard proposals that have been developed and incorporated into production practice. It makes the calculations for the optimum version according to a program prepared in advance and loaded in the computer. This has reduced to between one-third and one-fourth the time required to design jigs and fixtures, and it has reduced to less than half the costs of obtaining drawings. Their quality has improved; they do not contain errors. The automatic machine does its own checking. It is this kind of automation that in large part made it possible to complete the design of jigs and fixtures ahead of schedule for machining the blades of the 25,000-kw GTN-25 gas pumping unit. It had to analyze all the designs of production jigs

and fixtures used for machining turbine blades, to compile a unified table of initial data for them, and to code all the reference documentation and documentation on sizes and specifications.

But use of a system for computerizing design work [SAPR] affords still greater opportunities. The first phase of the SAPR created with the help of the Cybernetics Institute imeni V.M. Glushkov of the UkSSR Academy of Sciences, and other scientific research organizations in the country has been released at the association's head institute "Energomashproyekt." It is used in designing the sector's enterprises. The entire job is done with the most active creative input from the designer. As coauthors of a single development man and machine exchange data with one another. Of course, the initiative comes from the man: he revises, modifies, and corrects the working documentation. At his command the computer performs everything skillfully and alertly records the slightest discrepancy in the design of, say, a future shop. In this way the specialists of the head institute "Energomashproyekt" have achieved a faster pace in all stages of the process of working out a design. In certain design operations they have managed to reduce the labor inputs by 95 percent.

A new era has opened in automating the work of the designer in VPTIenergomash as well. Here they have also begun to introduce an SAPR. Old equipment is being written off, and the rooms are being prepared for installation of new machines. At the present time the topic plan of the institute's projects is being worked out, and standard designs are being designated whose performance can in the future be turned over to the computer.

7045
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IMPROVING THE ORGANIZATIONAL AND PLANNING PREPARATION OF INDUSTRIAL PROCESSES ON THE BASIS OF YeSTPP [UNIFIED SYSTEM OF TECHNOLOGICAL PREPARATION OF PRODUCTION]

Moscow TRAKTORY I SELKHOZMASHINY in Russian No 3, Mar 86 pp 40-43

[Article by L.V. Rozenblyum, candidate of physical-mathematical sciences, and B.V. Trembovolskiy, engineer, Minsk Tractor Factory, published under the rubric "Industrial Process Engineering, Organization and Economics":
"Improving the Organizational and Planning Preparation of Industrial Processes on the Basis of YeSTPP [Unified System of Technological Preparation of Production]

[Text] The current stage in the development of ASU [management automation systems] is characterized by the tendency to create models describing the management processes in a real industrial environment as precisely as possible. This is attained by improving the accuracy of calculations and accelerating the rate of output of the required data. Raising the calculation accuracy involves spending more computer time, while real-time operation of the system imposes limitations on how much of it can be spent. As a result, a modern integrated ASU operating in close informational communication with its various subsystems is faced with the need to minimize the computation time as an urgent problem not only for the modules operating in real time but also for other modules linked with them informationally, including the modules of organizational-planning preparation of industrial production.

In order to find ways of improving the organizational-planning preparation in an ASU, we will identify certain major features of factories manufacturing products in large batches or series. Such factories are characterized by rapid rates and large volumes of product output, making it imperative to estimate all normatives with high accuracy and adjust these estimates frequently. The magnitude of these adjustments, however, are relatively small and usually not larger than 10 percent of the core files in the data bank. Once introduced, a product continues to be turned out with a relative stability for several years. The cost of optimizing the algorithms of organization-planning preparation will thus be fully absorbed. In addition, the preparatory processes usually apply to a family of products consisting of a small number of basic models and their numerous implementations.

These features can be taken into account in formulating the problems involved in the organizational and planning preparation and effective solutions of these problems in ASUP [plant management automation systems]. On the other hand, the acting standards regulating the documentation and algorithms used in solving the problems of technological preparation of production overlook the possibility of optimization in terms of minimum computation time. We will consider four possible strategies that can improve the efficacy of solution of the problems in organizational-planning preparation of industrial production.

I. The relative stability of production processes and the limited amount of corrections make it possible to develop effective calculation algorithms according to the deviation principle. The general concept is calculating only the corrections introduced into the existing output data file each time a correction is necessary.

II. An alternative strategy for improving the efficacy of solutions is based on the fact that in most cases a limited number of core models are produced in a large number of alternative implementations. If the data structures are described as discrete functions defined on the paths in an oriented graph of product mix, then in the language of graphs this means that these functions will have the same value on the various paths terminating at the same point. We assume that the graph of product mix is directed downward from products to parts and assembly units (PAU): The beginning of an arc (the top node) is an assembly unit, while the end of an arc (lower node) is PAU belonging to it. The different discrete functions will correspond to different files. The file of the set of assembly units, for example, is determined by the function defined on the arcs on the graph, and the value of the function assigned to an arc is the applicability of a PAU in an assembly unit. The file of complete applicability is defined on the graph paths, while the value of a function is the complete applicability of a PAU (and of path) in a product (beginning of path). Paths which begin and end at the same points are identified. Two nodes are referred to as functionally linked if the path connecting them belongs to the definition domain of a discrete function E.

The underlying idea of this method is to leave just one of all of the paths ending at the same lower node, where the function E has the same values, and eliminating the other paths from the domain of the function E. The path that is preserved is marked in a special fashion (by a permanent data feature--PDF), making it possible to reconstruct all omitted information when using the graph. We will denote this method by the term algorithmic convolution [1]. Obviously, it reduces the volume of files being used, because this volume depends on the domain of the function E.

We can now consider the possible implementations of this method. We first identify a set M of certain nodes which are the beginnings of those paths on which the function E assumes frequently the same values for many of the bottom nodes. In a particular file, these nodes are determined from an analysis of some qualitative features, for example, the coefficient of

reciprocal unification of products. In order to reduce the definition domain of the function E, we can combine the nodes of M into several overlapping groups G_i $(i = \overline{1,k})$. We denote the family of such groups by G and call it a grouping. We will assume that in the set M the relation of order has been defined in some fashion. In practice, this set usually has some natural order associated with coding. A subset of a certain ordered set will be called right- (or left-) linear if this subset includes the smallest (or the largest) element and all larger (or smaller) elements of the given set. For example, for the set {1,2,3,4} the subsets {1,2} and {2,3,4} are the left- and right-linear subsets, respectively, while the subset {2,4} is a nonlinear subset.

Consider the set M_a of all top nodes of M, functionally connected with a certain bottom node a. We can partition the set M_a into nonintersecting classes τ_j $(j = \overline{1,m})$, placing in the same class the nodes b_k which have the same values of the function E on the path from b_k to a. Making use of the grouping G, we can condense information for each class τj in the following ways.

A. If the intersection G_i^* of a certain group G_i with the class τ_j is a right- or left-linear subset in G_i, then in the domain Ω of the function E we preserve among all the paths linking the node a with the nodes of G_i^* only one path, eliminating all the others. The remaining path is marked by PDF equal to +i if G_i^* is a right-linear subset or by -i if it is left-linear.

B. The condensation is done similar to method A, except that the condition $G_i^* = G_i$ is assumed. The value of i is taken without a sign.

C. Assume that a grouping G consists of pairwise nonintersecting groups G_i. Then for a certain group G_i remove from the class τ_j all paths of the domain Ω emanating from the top nodes and belonging to G_j except for one path. This path from the node b_0 should be labeled by PDF. For the other paths emanating from the nodes $b \in G_i$, the value of the function E is replaced by $\Delta E = E - E_{b_0}$, where E_{b_0} is the value of the function on a path from the base node b_0 to the node a.

The condensation according to the method A, where only right-linear subsets are used, is employed according to USSR State Standard GOST 2.113-75, "Group and Base Design Documents," when filling the group design certificates according to alternatives A, C and D. In this case each group includes assembly units which differ only in their implementation number. The permanent data feature in this case is defined implicitly for all lines of the document up to the section entitled "Variable Data for Implementation." According to variant B, PDF is not defined but can also be introduced for the lines where starting from a certain implementation of an assembly unit the applicability values become identical.

These methods of data condensation are a generalization of those used in YeSTPP and can reduce the volumes of information processed in organizational-planning preparation of production substantially.

III. Another approach for condensing information to be placed in the main storage (MS) of the computer and constructing an algorithm with reduced time of problem computation is based on a file compaction. By compaction we mean the following operation [2].

The input file is read into the MS and divided in all accessible regions into a set of subfiles whose records contain only some of the requisites of the input record. Address cross-references are established between the records of the different subfiles. Such distributed and coordinated data structures are not new and are in fact widely used in data bases. In our cases, however, this idea is used not for organizing the data base but for handling certain specific files which usually consist of records of a fixed length utilizing a sequential or sequential-index access method. In ASUP such files are used commonly because of easy operation, updating, simple software for file sorting, rewriting, etc.

The compaction of a file is associated with the following advantages.

1. The volume occupied by such a file in MS is much smaller than the initial volume. In certain cases the entire file can be placed in MS in a compact form, while the initial file could not be accommodated in it.

2. The searching time of a record in a file by a given subkey is reduced, because it is possible to construct in MS a subfile where the subkey will be the full key of a record, so that the search could be conducted by nonrepeating subkey values alone.

3. It becomes possible to devise more effective algorithms, reducing the computer operation time substantially.

This method can be used efficiently when for solving a problem it is insufficient to simply scan the initial file, but either the scan has to be repeated or records must be extracted from the file at random on the basis of specified keys.

We will illustrate the compaction of a file of the list of assembly units (AU) representing design specifications. We assume that a memory capacity of 256 kilobytes is assigned for the file. The following notations will be used. If a record z of the file Z consists of the requisites a, b, c ..., f, k, ℓ ..., it will be denoted as follows:

$$z = (a, b, c, \ldots; \ f, k, \ell, \ldots),$$

where a, b and c are key requisites; the sequence of enumeration of these requisites indicates the sorting of the file Z. A set of key requisites defines a record unequivocally and constitutes its key; f, k and ℓ are base requisites.

Notations $|Z|$, $|z|$ and $|r|$ refer to the size of the file Z, measured as the number of records in it, the length of the record z and the length of the

requisite r in bytes, respectively. The expression $f_Z(a,b,c)$ identifies the requisite f in a record of the file Z with the key (a,b,c). A typical structure of a record in a file of AU appears as follows:

$$z = (c, dc; l),$$

where dc is the code of PAU included in the assembly unit c at the first level of inclusion and l specifies the amount used.

For simplicity, we do not consider here the compaction of an AU file utilizing the algorithmic convolution which introduces into the structure of the record z a PDF.

The file of AU is the input data file for one of the main problems calculated in ASUP: "Evaluation of the Applicability of PAU in Products." Several algorithms for solving this problem with a sequentially organized file of AU are known; the following can be cited:

- method of deaggregation of assemblies from the top (GOST 3.1301-74);
- calculations with the principle of deviations; and
- the matrix method.

In an algorithmic implementation of this problem and other problems in organizational-planning preparation, it is necessary to create and reshuffle fairly large intermediate files, involving considerable computer time. When the file of AU is compacted, in many cases it can be placed in MS, so that the algorithm solving this problem can be reconstructed with substantial saving of computer time.

Without describing this new algorithm, we will indicate the method of compacting this file with special reference to the ASU of MTZ [Minsk Tractor Factory]. The AU in this case have the following characteristics: $|AU| = 41{,}000$, $|c| = |dc| = 6$ and $|l| = 2$, the requisite l contains not more than three digits, the total number of nonrecurring values of the codes c and cd is not greater than 5000. From these data it follows that $|z| = 14$ ($z \in AU$) and AU in the original form will occupy $|z| \cdot |AU| = 574{,}000$ bytes, which is much larger than the MS section assigned for it.

We can compact the AU file in MS. To this end, we divide it into two subfiles, Z_1 and Z_2, consisting of records $z_1 = (dc; adr_1)$ and $z_2 = (adr_2; l, \alpha)$, where adr_1 indicates the beginning of a string of records z_{2j} which define dc_j belonging to the assembly unit dc; the values of dc_j are contained in the records z_1 under the addresses adr_{2j}; l is the applicability of dc_j in the assembly unit dc and α is a single-bit feature of the end of the string.

Here and in subsequent discussion, the address of a record is understood not as its real address in MS but as its serial number in the file. Besides, we assume that $|adr| = 2$.

If dc is a component and not an assembly unit, then $adr_1 = 0$. We will define in bytes the size of the compacted file of AU. We have $|z_1| = |dc| + |adr_1| = 8$, $|Z_1| = 5000$, $|z_2| = |adr_2| + |\tau| = 4$, $|Z_2| = 41{,}000$. Note that the single-bit requisite α does not affect the length of Z_1, because it is included in the field of the requisite τ. The files Z_1 and Z_2 will therefore occupy in MS the volumes of $|z_1| \cdot |Z_1| = 40{,}000$ and $|z_2| \cdot |Z_2| = 164{,}000$ bytes, respectively, and the entire compacted file of AU will take up 204,000 bytes. The compact AU file, therefore, occupies just a little more than one-third of the initial memory capacity and can be accommodated in the corresponding section of MS.

In the course of decomposition of assemblies node by node, the system has from a given requisite dc to find in AU file all the records $z_j = (c_j, dc_j; \tau_j)$ in which $c_j = dc$. This operation can be carried out conveniently in a compact AU file. With this file it is no longer necessary to create, review and reshuffle intermediate files; the end file is generated in one step. All the three advantages of operation with compact files are thus observed when compacting the AU file.

IV. In the data bank of ASUP it is possible to form automatically from a small number of base files a nonrecurring list of main key requites. For organization-planning preparation, in all initial files it is possible, by using the lists of keys, to substitute for their code values the serial numbers under which they occur in the lists, i.e., utilize their addresses. All calculations will be performed with address files. This will reduce the file size, because codes are usually longer than addresses. In addition, with address files a key can be found faster directly by its address. For printouts and in forming the files for storage, addresses can easily be converted into codes with the aid of the lists.

Different lists can be formed for different problems. For each particular problem a minimum-sized list can be used which will contain only the keys relevant to the problem concerned. For conjugation of the address files in different problems, a procedure of list "expansion" is introduced, which is implemented by a simple algorithm.

Without elaborating on the first, third and fourth approaches, we will consider some of the optimization problems that arise with the second strategy based on algorithmic convolution of information.

First, it is necessary to find an optimal grouping G which provides maximum compaction. Secondly, algorithms for maximum compaction on the basis of this grouping must be developed. Thirdly, it is possible to consider the problem of optimal organization of the set M of the top nodes of the graph of products, i.e., organizing it in a manner that would maximize compaction.

Achieving the first goal with the grouping G consisting of nonintersecting groups is trivial. With compactions according to the method B, it is obviously sufficient to define a grouping G consisting of all the three classes τ_j of the set M_α, in which $|\tau_j| > 1$, where $|\tau_j|$ is the number of elements

in the class τ_j. With compaction according to the method A, one should consider the right-linear subsets and eliminate those classes which are right-linear subsets of at least one of the other classes. For compaction according to the method A, one should first eliminate both on the right and left all right- and left-linear subsets and then combine into one class all such pairs of classes which constitute linear subsets of this combined class on the left and on the right, respectively.

In practice it may often be convenient to limit the number of overlapping groups G_i in the grouping G for easier manipulations with algorithmically convolved information. In this case, the problem becomes more difficult. If different totals have to be computed, it is more convenient to use a grouping consisting of nonintersecting groups. We will describe the general algorithm of finding the optimal grouping for an algorithmic convolution according to the method A.

Considering a set of existing identical classes τ_j at all the bottom nodes a of the graph, we can determine their multiplicity S_j, i.e., the number of recurrences of each class. Then for each class we consider the classes which are its proper subsets and increase their multiplicites by the multiplicies of the class itself. As a result, we obtain total multiplicities S_j of all classes τ_j. We denote the initial file with information about the functions defined on the paths of the graph by K; after algorithmic convolution it is denoted by K'. The weight of the grouping G is defined as the number $v_G = |K| - |K'|$. After finding the total multiplicities of the classes ν_j, we find their weights ν_j, whose values are equal to the numbers of paths removed by algorithmic convolution. The weight ν_j is defined according to the expression

$$\nu_j = S_j(|\tau_j| - 1) + \sum_{f=1}^{p} S_f(|\tau_f| - 1),$$

where f runs through all the right- (left-) linear subsets of the class τ_j, $f = \overline{1, p}$.

For algorithmic convolution according to the method B, the formula for estimating ν_j consists of just the first term.

The final step of the algorithm is finding the optimal grouping G. To this end, a generator partitioning the set M into nonintersecting groups can be used; then, for each partition $G = (G_1, \ldots, G_i, \ldots, G_k)$ the algorithm will calculate the weight

$$v_G = \sum_{i=1}^{k} \nu_i.$$

The partition with the largest weight is the optimal partition. Finding the optimal partition can be interpreted as the problem of covering the set M by

an ensemble G of its pairwise nonintersecting subsets G_i with weights ν_i assigned to them.

The problem of finding a covering with the maximum weight can be stated in terms of Boolean programming. We introduce two Boolean variables:

$$a_{ij} = \begin{cases} 1, & \text{if the element } b_j \in M \\ & \text{belongs to the class } G_i, \\ 0, & \text{otherwise.} \end{cases}$$

$$X_i^G = \begin{cases} 1, & \text{if } G_i \text{ belongs to the} \\ & \text{covering G,} \\ 0, & \text{otherwise.} \end{cases}$$

The problem is then reduced to integral (Boolean programming)

$$\sum_{i=1}^{2^n} \nu_i X_i^G \to \max, \quad \sum_{i=1}^{2^n} a_{ij} X_i^G = 1, \quad j = \overline{1, n}.$$

For algorithmic convolution according to the method C, the algorithm finding the optimal grouping is somewhat more complicated. The difference consists in the fact that it employs a special condition of applicability of the convolution according to the method C to the class τ_j and calculates its weight.

The above algorithms have been employed to find an optimal grouping of tractors of MTZ in the applicability file of PAU in products. Computations were performed with eight base models. Convolutions according to the method A were used for nonintersecting groups, achieving the maximum theoretical compaction by 2.8 times with 10 groups. For nonintersecting groups an optimal partition has been found which consisted of three groups for the algorithm A and of two groups for the algorithm C. The degree of compaction with the algorithms A and C was virtually the same (by a factor of 1.9), suggesting that the algorithm A is preferable because of its greater simplicity and visualization.

The second and third problems in algorithmic convolution require separate analysis and are not considered here.

The methods for improvement of organization-planning preparation of production in ASUP described in this paper have made it possible to increase the operation efficiency of the management system built according to ESTPP principles.

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PROBLEMS OF ASSURING CONTROLLABILITY OF MICROPROCESSOR COMPLEXES FOR CONTROL OF COMPLEX TECHNOLOGICAL OBJECTS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 30 Dec 85) pp 70-75

[Article by V.A. Guayayev]

[Abstract] General statements and definitions are presented which should be considered in the design of complex computer control systems implemented with modern microprocessor technology. The basic problem is seen as one of assuring that the systems can be monitored to verify correct functioning. The basic principles of organization of an effective diagnostic process are presented. The preparation of tests for microprocessor system modules remains an important task. Such tests must assure a high level of reliability of testing while using relatively little memory. The creation of special LSI and VLSI devices for testing purposes is an effective means of improvement of microprocessor system diagnosis.

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HIERARCHY OF PROBLEMS AND MATHEMATICAL MODELS FOR OPTIMIZATION OF GAS TRANSPORT SYSTEM DEVELOPMENT

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 21 Nov 85) pp 86-90, 111

[Article by M.N. Kulik, G.V. Voytsekhovskaya, A.I. Gumenyuk and V.A. Ronto]

[Abstract] There are two major stages of administration of system development of gas transport systems: Long-term planning of the development of gas transport systems; and immediate planning of transport system development. This article notes the basic decisions which must be made in each stage and suggests a hierarchy of decision levels for the process. A system of nonlinear mathematical models is suggested as a means of selecting the first objects for construction in a gas transport system in the present five year plan and selection of planned objects for the next two five year plans. This complex of models is used for a detailed and systematic analysis of the distribution levels of the gas transport system in order to find optimal technically permissible designs suitable for the conditions at hand. Figures 2, references 17: Russian.

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METHOD OF MACHINE ANALYSIS OF SEQUENTIAL COMPUTATION PROCESSES

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 3, May-Jun 86 (manuscript received 14 Dec 84) pp 13-17

[Article by A.G. Dodonov and V.L. Patrikeyev]

[Abstract] The requirements for methods intended to analyze sequential computation processes with severe limitations on parallel functioning of elements are outlined. A formal definition and formal model of a sequential computer process are presented. The sufficiency of the formal model is demonstrated and practical implementation of the method is discussed. An input language is suggested, oriented toward analysis of algorithms and programs with certain limitations on modular electronic circuits. The language utilizes scalar and limited variable types as in PASCAL, plus a "signal" variable for binary logical variables, allowing description of logic circuits in a manner natural to electronic circuit designers. The method is based on formation of the minimal coverage, a tree-shaped recording of all possible behavior of the computational process resulting from simulation.
Figures 2, references 8: Russian.

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UDC 681.325.5

MODELING OF VARIATION PROBLEMS USING THE SHORTEST PATH METHOD

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 3 Feb 86) pp 9-12

[Article by V.V. Vasilev]

[Abstract] A previous work by the same author suggested an approximate method for solving variational problems, based on their reduction to equivalent

problems in determination of the shortest path in homogeneous network grids. This article uses this approach to study various aspects of modeling of variational problems, keeping in mind that specialized modeling systems with high information productivity have been created for the modeling of external path problems. Actualizations of the method are presented for modeling of problems with movable boundaries, with functionals dependent on two functions, isoperimeter problems, as well as fields of extremals and transversals. Figures 4, references 4: 3 Russian, 1 Ukrainian.

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T-TRANSFORMS OF COMPLEX SYSTEMS OF DIFFERENTIAL EQUATIONS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 2 Jan 86) pp 16-21

[Article by N.I. Ronto]

[Abstract] A study is made of problems of developing Pukhov T-transforms for two rather broad classes of complex differential equations, the coefficients and solutions of which are continuously differentiable complex functions of a real variable and a complex variable. Methods based on differential T-transforms are thus extended to complex differential equations of a complex argument. References 28: Russian.

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UDC 517.943+517.949.2:681.142.4

STUDY OF DYNAMIC SYSTEMS WITH SLOW CHANGES IN INPUT SIGNAL PARAMETERS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian, No 4, Jul-Aug 86 (manuscript received 17 Jan 86) pp 41-44

[Article by I.M. Romanishin and L.A. Sinitskiy]

[Abstract] The method of differential transforms based on Taylor series is used only for the analysis of linear systems with constant parameters. This article demonstrates possible extensions of the method allowing determination of approximate solutions for a number of problems in the theory of chains. The procedure used to search for the approximate solution is convenient for

analysis of the effects of modulated oscillations on nonlinear systems. It can be easily embedded in a time analysis algorithm which can be implemented by means of programs used in the design of electronic circuits.
References 9: Russian.

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TEACHING COMPUTER LITERACY

Frunze KOMMUNIST KIRGIZSTANA in Russian No 6, Jun 86 pp 81-84

[Article by V. Gritskevich, director of Secondary School No 61 imeni I.V. Kurchatov, Frunze]

[Text] Along with all the Soviet people, our republic's educators received the decisions of the 27th CPSU Congress, which will go down in the biography of the Country of Soviets as a historic landmark, with very warm approval. The congress pointed out that our forward movement along the road of building communism goes by way of intensification of the country's economy. The acceleration of scientific-technical progress and the widespread introduction of new generations of equipment, fundamentally new technologies that guarantee the highest productivity and efficiency, will serve as the principal lever for intensification.

"What we have to do," M.S. Gorbachev, general secretary of the CPSU Central Committee, emphasized in the speech he delivered at the conference in the headquarters of the CPSU Central Committee on the problems of acceleration of scientific-technical progress, "is to accomplish a new technical reconstruction of the economy, to qualitatively transform the material and technical base of society.... What has been outlined can be implemented only by intensification of production on the basis of the most recent advances of science and technology."

A new type of worker, a specialist capable of creative solution of production problems, a man with a thorough knowledge of the polytechnical foundations of present-day production, able to quickly master the most up-to-date equipment and technology, is needed to work in the context of present-day production.

Present-day computers are being applied in scientific research to evaluate, store, and process information arriving from various devices, in the control of manufacturing processes and in inspection of products, as well as in the design of new technology in many sectors of science and technology. That is why the party and government have constantly been paying attention to the development and application of computers to production. It is no accident, then, that the Politburo of the CPSU Central Committee adopted in one of its sessions a nationwide program for creation, development of production, and effective use of computer equipment and automated control and management systems

up to the year 2000. This program is aimed at accelerating the growth rate of the manufacture of computers, improving their quality, organizing the production of new computers for scientific research, and solving applications problems in various sectors of the economy. Man now has occasion to carry on intercourse with the computer in one form or another in practically all spheres of activity. It is accordingly very important that computers be mastered not only by VUZ graduates, but to a corresponding extent by the graduates of secondary schools and vocational and technical schools as well.

In the documents of the party and government on school reform a broad program has been outlined for studying computers and the basic elements of informatics in the upper grades. Schoolchildren will acquire qualitatively new habits in dealing with the unlimited world of information. But it is not only as a teaching and learning tool that the computer should be mastered. Mastering the computer in the present-day school is also a preparation for the workplace necessary to work in various sectors of the economy.

"Arming the students with knowledge and the habits of using present-day computers and ensuring broad use of computers in the teaching process," that is how the task is set in the Basic Directions of the School Reform, and this is also demanded by the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Further Improvement of General Secondary Education of Young People and on Improvement of the Conditions for the Operation of the General Secondary School." Students must learn to make use of the most up-to-date computers so that then they can know how to use them in their subsequent practical activity. Since computers are being introduced at an accelerating pace in all sectors of the economy, computer literacy is very much needed by the school graduate who is beginning his independent life. The display screen will be necessary to him if he will be working in a machinebuilding plant equipped with microprocessor equipment; by issuing commands to the computer, he will be able to quickly obtain the necessary parts. Computers are now at the service of many vocations in machinebuilding enterprises, transportation, agriculture, and so on.

Speaking at the conference on the problems of scientific-technical progress, Comrade M.S. Gorbachev emphasized that much depends not only on increasing the output of computers, but also on the range and skill of their use in the economy. That is why a course entitled "Basic Elements of Informatics and Computers" was introduced in all the country's secondary educational institutions beginning in the academic year 1985/86. Party and soviet authorities in Frunze, the Pervomayskiy Rayon Committee of the Communist Party of Kirghizia, and the faculty of our school have come to perceive the decisions of the Politburo of the CPSU Central Committee and the Basic Directions of the Reform of the General Secondary School as a task requiring immediate performance.

Much attention is being paid to this important question in our own Pervomayskiy Rayon. For example, the schools have been assigned to ministries, departments, and enterprises which have up-to-date computers. They have been ordered by the beginning of the academic year to set up informatics and computer rooms in the schools and to send specialists to teach the students. The training of mathematics and physics teachers in the skills of teaching this subject was

organized, and a seminar was held with the managers of enterprises, senior ministry officials, and school principals.

A rayon teachers' conference was held on this set of topics at the Frunze Polytechnical Institute under the slogan "VUZ--the secondary school." The speeches made by Prof V. Zhuravlev, rector of Frunze Polytechnical Institute, and Prof A. Akayev, corresponding member of the KiSSR Academy of Sciences and doctor of engineering sciences, pointed up the great importance of applying computers to the teaching process and the great need for active participation of enterprises, ministries, departments, and VUZ in this important nationwide cause.

The collective of our school attributes great importance to the computer literacy of the students, which ultimately is called upon to contribute to acceleration of scientific-technical progress.

Six years ago a good system was set up for collaboration of our school, which bears the name of the outstanding physical scientist I.V. Kurchatov, with the Frunze Polytechnical Institute and then also with the Instrumentmaking Plant imeni 50-Letiye Kirgizskoy SSR. Our school's academic director Ye. Yakir, a tireless enthusiast who has been recognized as a distinguished teacher of KiSSR and an excellent teacher, deserves quite a bit of credit for this.

With the help of the polytechnical institute and the instrumentmaking plant a room for informatics and computers has been set up in the school, and a display classroom was set up with the installation of 12 "Agat" personal computers.

Informatics, computers, and computer programming have been taught in our school since 1979. Leading faculty members of the institute B. Rapaport, V. Tolstunova, L. Desyatkova, and others have been enlisted to give workshops. Back in 1978 a "Young Programmer" group was created in the computer department of the Frunze Polytechnical Institute for students from our school, and it laid the foundations of the subject that was completely new for the general secondary school. Up until that academic year the students did their workshops in the computer center of the Frunze Polytechnical Institute using the "Nairi-2" and "Nairi-K" computers. They studied the programming language "a" and machine language.

Then the teaching was done in the computer center of the computer department of the Frunze Polytechnical Institute using "M-4030," "SM-4," and "Elektronika-60" computers. Now classes are scheduled in two specialized rooms: the programming and computer room and the display classroom. The display classroom has also been made available for the practical exercises of students from schools in Pervomayskiy Rayon in the city of Frunze and will be used to train teachers who will be teaching the new course. Now there are 260 ninth-graders and 225 tenth-graders learning informatics and programming and how to operate the computer; they are gaining practical experience in interacting with present-day computers, the basic elements of writing algorithms for computational processes, the basic elements of programming in the interactive language BASIC and the problem-reference programming language FORTRAN.

Individual work is done with certain of the school's students. They are involved in scientific research projects using the computer. The students have presented the results of these projects at scientific-technical conferences of university students at the Frunze Polytechnical Institute as well as in all-union conferences. The subject of computers is arousing greater interest on the part of the students. Exercises in programming get them used to being systematic, since each successive topic presupposes a good mastery of the material under the previous topics and gets them accustomed to working independently and being precise, since without those attributes programming cannot be mastered. Solving problems on the computer develops research skills; in doing programming on the computer the schoolchild teaches himself to analyze the various methods of solution and to choose the best of them on a sound basis.

Quite a few of the school's graduates are studying at the Frunze Polytechnical Institute and other VUZ's in the country in specialties related to the development, design, operation, and programming of computers.

The level of training of the school's graduates in computer programming is such that they are able to use the knowledge they have gained in the school directly in their practical activity, and even when they are called into the ranks of the Soviet Army they can operate sophisticated weapons connected to a computer without special prior training.

When our school's graduates have passed the computer examination, when they receive their secondary diploma they also receive a certificate stating that they have taken the 2-year course of study in the syllabus "Programming and Work With the Computer" in association with the Frunze Polytechnical Institute.

We feel that every teacher must master the basic elements of computers and be able to explain the ideas of programming to the students in the process of teaching his own subject. And we have already taken the first steps in this direction; there are biology programs for 9th- and 10th-graders. All the school's teachers have been learning since May using our own facilities.

The faculty of Secondary School No 61 imeni I.V. Kurchatov is fully aware of its responsibility for effective achievement of the requirements of the school reform.

In our everyday activity we are guided by the proposition in our party program to the effect that the reform of the general secondary and vocational school being carried out in the country is based on creative development of the Leninist principles of the unified polytechnical work school and is aimed at raising still higher the level of education and upbringing of young people, at improving their training for independent life in the workplace, and at making the gradual transition to universal vocational education.

The party has been unceasingly concerned about teaching personnel, about bolstering and developing the physical facilities for public education. It is our duty, and we are prepared for it, to respond to the party's concern with conscientious work in training conscious and highly educated people capable both of physical and mental work as well as vigorous activity in all spheres of the country's economic, social, and cultural life.

7045
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COLLEGE-LEVEL TEACHING COMPUTERS DISCUSSED

Riga SOVETSKAYA LATVIYA in Russian 21 May 86 p 3

[Article by Ye. Zarutskaya: "University Students Taught by Computer"]

[Text] An inter-VUZ seminar on the topic "Mathematical Models and Computer Science in Managing the Teaching Process in Higher Education" opened yesterday in the Science Center in Yurmala. This is the third time that the country's specialists have come together in our republic for a seminar like this. Nor is that any accident. Today Latvia occupies one of the leading places in the use of computers in teaching university students.

The Riga Polytechnical Institute imeni A. Pelshe, one of the organizers of this convention of scientists, has done extensive work in creating automatic teaching systems and methods of representing data bases within them, to develop teaching courses, and to build models of the learning process itself. Classrooms using computer displays were created here and are already being used in higher educational institutions, as is the "Asoliya" system for learning foreign languages. The "Kontakt" automatic system is an aid in learning programming. The software for the various courses has been prepared by the people in Riga for VUZ's in Ufa, Vilnius, and other cities.

"Our seminars are very worthwhile and fruitful," says L. Leontyev, doctor of engineering sciences and professor in the department of automatic control systems of the Riga Polytechnical Institute. "So far there is not a single periodical in the country that covers these problems. Yet there is a need for a comprehensive exchange. Computer science is taking only its first steps in management of the teaching process and is raising many questions. For example, what is the teaching process: offering some total amount of finished knowledge, or teaching the learner to think? Or again: What are the psychological problems of the contact between "man and the machine," and so on? In order to solve these complicated problems we are working in conjunction with the specialists of many fields of science.

More than 200 participants in the seminar have traveled to Riga from many cities in the country. In addition to specialists from higher educational institutions, teachers from secondary schools and tekhnikums concerned with informatics have also come to take part in it.

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OBSTACLES TO COMPUTERIZATION

Moscow PRAVDA in Russian 29 Aug 86 p 3

[Article by V. Frolov, candidate of engineering sciences: "Hello, Computer!"]

[Text] "Hello!" they say to it in the schools of Moscow and Kamchatka.

"Laba dena!"--it is greeted by the schoolchildren in Vilnius.

"Zdorovenki buly!" are the greetings from Kiev.

"Salam!" is the greeting in Baku.

The school computer has not come to the schoolchildren of our country on a visit, but for good!

There it stands on the classroom table, which has seen some things in its time, shining with brand new features and an elegant coffee-colored keyboard. The "big-eyed" box (the words "color box" were written on the packing cartons), consisting of complicated microcircuits and equally complicated programs--is a real wonder of the scientific-technical revolution. Computerization of public education is a nationwide concern; the country's VUZ's are making a large contribution to it, including Moscow University.

The express elevator speeds us to the 13th floor of the main building of MGU--that is the location of the laboratory of computer methods headed by Docent A. Mikhalev, candidate of physical and mathematical sciences. The blue-eyed "yamakhs," that is the name given to one of the models of the school computer, are flashing on the desks.

"There are other models about to come out as well," says A. Kushnirenko, the head teacher of the teaching research group, "manufactured by enterprises under various ministries: the 'Korvet,' the 'Elektronika UKNTs-P,'..."

"What do those letters at the end mean?"

"Teaching computer of the scientific center. The 'P' stands for personal."

"The 'Korvet,'" Kushnirenko goes on to say, "was created in the MGU, in the Nuclear Physics Institute, by a team headed by Prof A. Rakhimov, recipient of the Lenin Prize. Incidentally, a configuration for control of physical experiments was developed there with the help of Ye. Velikhov, member of the academy. One of its modules--a personal computer--proved to be so successful that it was recommended as a model for the school computer. It is simple and reliable and allows for the use of ordinary tape recorders and television sets as standard units.

"We also expect a great deal," Kushnirenko concluded, "from the model 'Elektronika' of the Ministry of Electronics Industry. If they manage to put it into large-scale series production, it will probably be the best school computer in the world. It uses an additional built-in processor."

I will clarify: Usually personal computers get along with one processor. This is the computer's main "workhorse." It does the reading and checks the logical expressions and it tells the other units how to operate. In short, the processor is the "alpha and omega." But synchronization of the operation of what amount to metagalaxies soldered into the microcircuits requires a division of labor. This also requires an additional processor, a control processor. One of the specialists referred to it as the "herder." Until the required time it allows its "(commands to the display)" to graze at will, but at the "designated moment it immediately brings its herd into the circle."

A year has now passed since the course "Fundamentals of Informatics and Computer Science" was introduced for the first time in the history of our country's public education. In that time a teaching program has been developed, a methods textbook has been written for the schools, and the retraining of 70,000 teachers of physics and mathematics has been organized. And the publishing house "Prosveshcheniye" has printed new textbooks in printings running into the millions so that by the beginning of the school year every schoolchild can receive one. Now an open competition has been advertised for the writing of a textbook entitled "Fundamentals of Informatics and Computer Science." It is open both to individuals and organizations. Applications have already been received from authors in various parts of the Union, including teaching staffs on Sakhalin and Kamchatka. The second part of the manual, which is intended for 10th-grade students, has not yet come out.

I leafed through the small bright blue book. The sections flashed by: "The Structure of the Computer"..."Familiarity With Programming"..."The Role of Computer in Contemporary Society"..."Prospects for Development of Computer Science".... The title of the last section is arresting: "Programming--The Second Literacy." I think it would be worthwhile for this little book to be read not only by schoolchildren, but also by their moms and dads. In our era of "complete and total computerization," for many people it would be like a primer in computer popular education. But at present the director of the country's largest specialized store "Pedagogicheskaya Kniga" only spreads his hands:

"The 'Fundamentals of Informatics'? No, and there won't be. They have all been distributed to the schools...."

But it is not just a question of textbooks. There are quite a few other barriers that stand in the way of complete computerization. First of all, there is the need to furnish all students the necessary equipment.

Second, popular computer education is possible only if there is a sufficient number of trained teachers. We will take the average statistical model of the schoolteacher as our point of departure. This is a middle-aged man who did not study informatics and computer science in the pedagogical VUZ. Experience has shown that it takes a teacher about 3 years to "complete his apprenticeship" in something new to him. For universal primary education we do not need individuals, but an entire "generation" of teachers with a new background.

That is why a planned retraining of the teaching staffs of schools has begun on the scale of the entire country. Its main aim is to shape in every teacher the initial and basic level of computer literacy, to teach extensive use of computer equipment in teaching and upbringing. The characteristic feature of the retraining program is that the workshops will be conducted only with the computer equipment of USSR Minpros. In other words, it is not permitted to use for the workshops large computers or personal and minicomputers which do not meet the requirements that must be met by the school computer.

Regular programs in primary universal computer education not only for schoolchildren, but also for teachers, began this past September on the second national television channel. They will be broadcast twice a week. One other new thing: the first issue of the public education journal INFORMATIKA I OBRAZOVANIYE [INFORMATICS AND EDUCATION] will be published before this year is over.

Just before the academic year began all-union gatherings of methods experts of the USSR Ministry of Education took place within the walls of Moscow State University and were devoted to the new stage in computer study. The participants heard lectures by well-known scientists, pedagogues, and responsible officials of the ministry. A. Yershov, member of the academy, delivered the final address with parting advice to the participants:

"I wish for you a serious frame of mind so that the keen interest which you have shown here during almost 3 weeks does not die out when you are far from Moscow. When you get home, in the various regions of our homeland, you be the astute selectionist of progressive know-how, since we are talking about a qualitatively new stage in public education, the computer stage. We are launching a large ship named 'School Informatics.' It is the job of every one of us to complete the construction of that ship, to maintain its seaworthiness and maneuverability, to keep up with it ourselves, and to embark on it our children and grandchildren so that in the 21st century they are fully prepared for the truly epochal changes that are coming...."

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CSO: 1863/4

RUSSIAN VS ENGLISH NOTATION

Tashkent PRAVDA VOSTOKA in Russian 12 Aug 86 p 2

[Article by U. Mannanov, docent in the department of technical cybernetics of the School for ASU of the Tashkent Polytechnical Institute: "What Sort of Computer Language Will We Have?"]

[Text] Teachers in schools and VUZ's have a common task of preparing educated and literate specialists for the country. In that connection the main thing today is to ensure universal computer literacy as an integral part of a man's general culture. Much here depends on the textbook. For a long time there has been a dispute about the textbook entitled "Fundamentals of Informatics and Computers" for secondary educational institutions edited by A.P. Yershov and V.M. Monakhov. The dispute was conducted in the pages of newspapers, scientific journals, and television programs. Moreover, the most frequent criticism was of the presentation of the new algorithmic language in Russian notation. Why, people said, frighten the schoolchild with a language which does not exist on the computer, especially since in the second part of the book, which is for the 10th grade, they study the BASIC programming languages, and FORTRAN is also recommended? They are all in English notation. For the information of the uninitiated reader: BASIC was developed in 1965 by J. Kemeny and T. Kurtzeli [sic] of Dartmouth College. FORTRAN was developed by J. Backus and his colleagues in 1957 (United States).

The question arises: Why in performing such a global task as computerization in our country, in implementing the school reform, are we beginning to teach the young generation the ABC's of programming after a pattern that is not altogether established? Let us deliberate a bit. The purpose of the course in the fundamentals of informatics which is now being taught in secondary schools is to help the schoolchildren get over a certain fear of computers, to give students a general idea of the world of the computer, and, most important, to develop in the schoolchild creative algorithmic thinking.

We have been applying various means of achieving that goal, among them programming which itself has a profound and precise influence on our way of thinking.

Consequently, computer literacy needs to be taught in the schools in a programming language with Russian notation. That is why we need to develop

high-level programming languages in Russian notation, to urgently explore and build models of a system of computers, including translators, compilers, and interpreters in Russian and the languages of the nationalities of the USSR and implement them on all the domestic computers.

We are talking about education, which always has been and always will be a national concept, by contrast with science, which is always international, and knowledge, which is always international.

Why does the Englishman or American think and write programs in his native language? And yet we do not!

It cannot be forgotten that this is being taught in our country on a large scale--in 1985 alone about 4 million students began to study the course in the fundamentals of informatics and computers, and by the third and final stage of the school reform, which we will reach in the mid-nineties, this course is to be introduced not only in the older and middle grades, but even in the early levels of study. This means that in 8-10 years the predominant majority of our Soviet society will master computer thinking.

We need to develop our domestic programming industry, not copy the one in the West, then we will not be forced (once again!) to play catch up....

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